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How the Boyd's Lane Salt Marsh Looked After Shooting and Before Filling. The Marsh Was 1200 Ft. Long with 8 Ft. to 15 Ft. of Muck

New Methods in Highway Fill Settlement Work in Rhode Island

CONFRONTED by an estimated cost of \$32,000 for the removal by dredging of unstable material within the right of way of a projected road, Rhode Island highway authorities decided to do the work with explosives by the fill settlement method. That the decision was based on sound engineering judgment is evident from the fact that, when the operation was nearing completion, the cost including labor, dynamite, exploders and material had totaled \$15,000.

A further economy was effected by reason of the fact that where, according to estimate, it would have required 75,000 cu. yd. of fill, had the muck and other unstable material been entirely removed, the salvaging of considerable of the better material by resorting to under-fill blasting had reduced the amount of fill necessary to an estimated total of 50,000 cu. yd.

The description of the work and the various novel methods employed is based on data supplied by Charles L. Woolley, Construction Engineer, Rhode Island State Board of Public Roads.

General Conditions.—This interesting operation was carried out in connection with the construction of Boyd's Lane, Portsmouth, R. I., where for a distance of 1,100 ft., the highway spans a salt marsh at 6 ft. above the water line. As planned, the fill when finished was to carry a 24-ft. bituminous macadam pavement with a 15 ft. gravel shoulder on either side and have a total width of 54 ft.

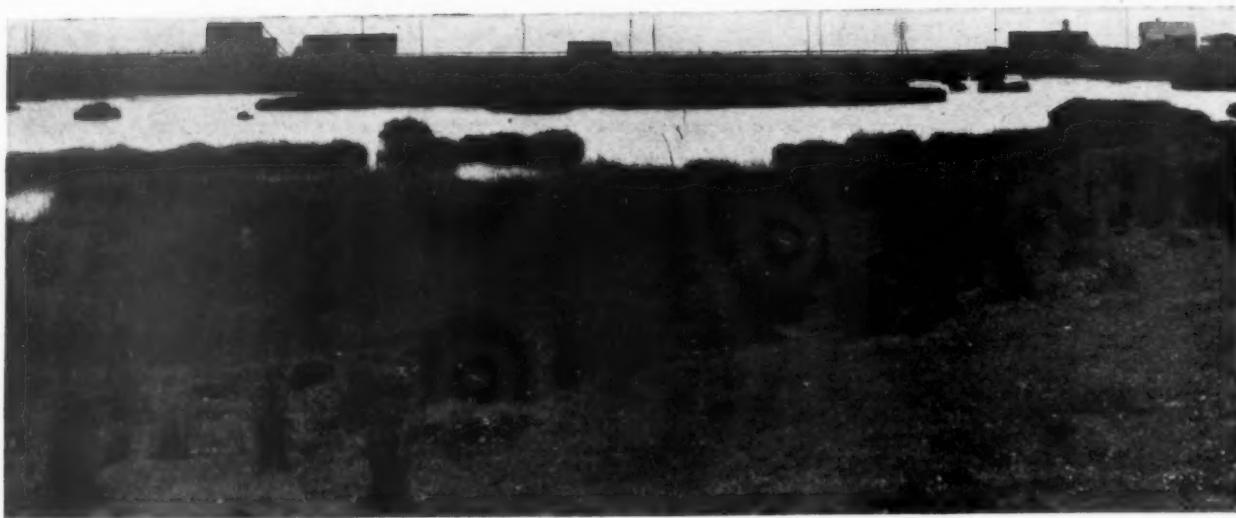
The surface of the marsh consisted of small ponds of open water dotted with islands of heavy marsh grass from 1 ft. to 2 ft. thick. Soundings revealed that the unstable material was separated by vertical layers or lenses of sandy material. Although these had consider-

able supporting power, the unstable material was almost fluid. It is believed that these lenses were due to tidal flow with consequent subsidence of marsh grass root mats together with sand deposits from some unusually high tides.

It was at once evident that these lenses must be destroyed in order to obviate the probability of subsequent failure which would result in disastrous effect upon the highway when completed, should these vertical strata of sand give way and permit movement of the fill.

The matter of procedure under the conditions was discussed with L. F. Livingston, an explosives expert connected with E. I. du Pont de Nemours & Company, and a plan was evolved. This was to blast a ditch 45 ft. to 50 ft. wide along the line of the projected road and to the full depth of the muck. The method adopted, it was believed, would be effectual in demolishing the sandy lenses as well as destroy the matted marsh grass, blow out large quantities of unstable material and liquefy the remaining muck. These objects were very satisfactorily accomplished.

Method of Blasting Ditch.—Ditching dynamite was loaded in a row of holes on the center-line and two parallel lines, spaced 20 ft. from the center row. These holes were on 2 ft. spacings. Varying with the depth of the unstable material, the holes of the center row were loaded with approximately 1 lb. of dynamite per foot of depth of mud and averaged 10 lbs. to a charge. The holes in the rows on either side of the center line contained an average of 8 lb. to a hole. The shooting was done by the propagated method whereby the detonation of one of the charges sets off the others in a row and for which an electric blasting cap is used as a primer and is fired by

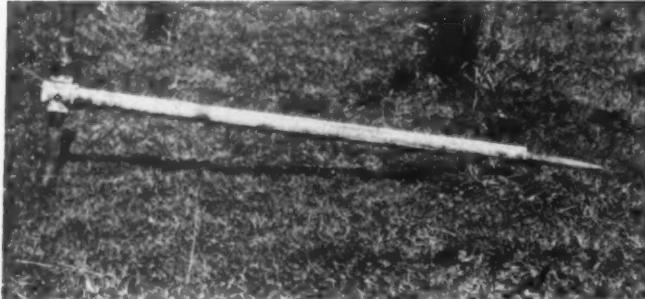


Original Condition of Boyd's Lane, Portsmouth, R. I.; Salt Marsh, 1200 Ft. Long; 8 Ft. to 15 Ft. of Muck

an electric blasting machine. It was intended that each of the rows of holes be shot separately. However, in the cases of some of the sections blasted, the shots propagated and all three rows exploded at once, despite the 20 ft. distance between the lines of holes.

Although most of the blasting was done with ditching dynamite, a change was made near the end of the operation, when one-half Gelex-A and one-half dynamite were used. The Gelex-A was loaded in the bottoms of the holes and ditching dynamite at the tops.

When the blasting was completed, there was provided



Driving and Loading Tool: 1½ In. Pipe Sleeve; 1 In. Pipe Core; Pointed End

an open trench of about 50 ft. width and with a depth of from 10 ft. to 12 ft. filled with water and liquid mud.

Placing Fill.—Trucks and bulldozers were used to place the fill at a rate of 1,000 to 1,500 yd. per day. It was arranged to handle the fill in such a way that the liquid mud was forced forward of the toe of the fill and the utmost care was taken to prevent the fill from being dumped on the mud itself. Since the placing of the fill pushed the mud ahead of it, with the result that the muck increased in quantity, it was found necessary to develop a method of relief. The usual means of doing this proved unsatisfactory.

New Torpedo Devised.—To meet the unexpected situation, E. Anthony, Resident Engineer on the job for the Rhode Island State Board of Public Roads, devised a type of torpedo which proved very effective. The torpedo consists of 1 in. by 2 in. furring strip, 10 ft. long to which sticks of ditching dynamite were tied. Two sticks at a time were used in making a torpedo varying in length from 6 ft. to 8 ft., according to the amount of dynamite used, with 7 lb. for one of 6 ft. length.

Mr. Woolley explains that the torpedoes were pushed by hand into the loose muck directly in front of the toe of the fill and as close to the fill as possible. They were placed in series of six to eight and when exploded gave 40 ft. to 50 ft. of open water, which permitted continuing the operation of filling. These torpedoes were very effective and allowed a great deal of flexibility in the placing of the charges.

"Except for one 50 ft. stretch where the fill had evidently pocketed a considerable quantity of mud," says Mr. Woolley, "there was no place where the fill over which the material was being drawn showed any signs of settlement. Ordinarily where a fill is built upon unstable material, it will quake under the trucks. Continued observations on the part of the engineers in charge did not disclose any quaking except at the point mentioned above. We felt quite sure that the new fill was securely locked in place. This method of blowing the loose muck away from the toe of the fill was used until about 50 ft. from the original ground. At this point, the muck became pocketed between the front of the fill and the shore and in spite of successive loads became too stiff to move. Several methods of blasting were tried but proved unsuccessful. The charges seemed only to



Driving Holes on 24 In. Centers



Making Torpedoes for Shooting Toe of Fill

blow small holes in the extremely tacky mud and gave no lifting effect. As the depth of the material was only about 3 ft., it was decided to fill over this section to hard ground and blast underneath should such prove necessary."

The result up to that time, showed that a stable fill had been placed and varied in depth from 6 ft. to 15 ft. and from 45 ft. to 50 ft. in width. It was required, however, that the completed fill have a width of 54 ft. between the shoulders. Mr. Woolley points out that in order to be certain that this added material on the sides did not drop out of sight as soon as the mud became agitated, a row of torpedoes was placed immediately alongside the shoulders, the shoulder fill loaded with excess burrow and the charges fired. The torpedoes used were 8 to 10 lb. each and were spaced 3 ft. apart.

The new fill dropped into place, but after the work had proceeded about half-way of the fill it was found that the shooting had disturbed the side support of the original fill core, and the entire fill began to quake. It was decided, however, to continue the shoulder shooting and the fill was widened out to its specified width and brought up to grade. The shoulder work was completed early in December of last year.

According to Mr. Woolley: "We immediately started an investigation of the quaking and found from test pits that we had from 10 ft. to 14 ft. of good fill material on top of from 2 ft. to 3 ft. of stiff sandy mud. The only method known to us for eliminating such mud pockets was the exploding of 15 to 20 lb. charges on 15 ft. to 20 ft. centers in these muck areas. During the operation of placing these charges on an experimental 50 ft. section, the weather turned cold and the fill froze. Upon exploding the charges no beneficial results were obtained and we only succeeded in blowing

craters in the fill. The work was stopped for the winter. The fill during this period from December to March had frozen and thawed a number of times."

As a result of frequent examinations, it was the opinion of the engineers that there would be no unequal settlement of any portion of the fill and that the stabilizing effect of the winter weather had removed the necessity of blasting under the operation.

Novel Plan of Loading Devised.—In describing an important phase of the major part of the work, which had to do with the placing of the original fills, Mr. Woolley said: "An interesting and novel plan of loading was developed. One inch and a half galvanized pipes were fitted with 'Ts' at one end and pipe handles attached to the sides of the 'T.' One inch galvanized pipe with a ring at one end and a solid point at the other end was used as a core-bar placed inside of the above mentioned sleeve. A detachable pin through the 'T' tied the core-bar and sleeve together. With this instrument, holes



Placing Torpedoes for Shooting Toe of Fill

some 2 ft. apart were worked through the mud. The core-bar when removed left the sleeve in place and the dynamite was loaded through the sleeve. A 1 3/4 in. turned oak tamping stick forced the dynamite into place. As the charges of dynamite were placed the sleeve was gradually lifted until the hole was completely filled with explosive to a level of 1 ft. below water. In this way dynamite was distributed for the full depth of the mud in a vertical line and the blasting effort was thereby distributed in a most efficient manner. By means of a simple raft made from telephone poles, the holes were made and the charges placed. By properly spacing the openings between the cross planks of the flooring of the raft, the raft when set on line could be used as a gauge for the spacing of the charges. Our custom was to load a line 50 ft. long at a time. A more extensive length of



Loading by Relief Ditch Method for Shooting Pocketed Material Between New Fill and Old Ground



Area Cleaned by Shooting

shots was not practicable because the work was near a main road and only 1,500 ft. from a group of houses."

Civil Service Examination for Engineers for U. S. Bureau of Public Roads

The U. S. Civil Service Commission has announced open competitive examinations for senior highway construction supervision, and senior highway design engineer. Applications for the positions must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than July 14, 1933.

The examinations are to fill vacancies in the Bureau of Public Roads, Department of Agriculture, Washington, D. C., and vacancies occurring in positions requiring similar qualifications throughout the United States. The entrance salaries for these positions range from \$4,600 to \$5,400 a year, less a deduction of not to exceed 15



Torpedoes in Place for Shoulder Shooting

per cent as a measure of economy and a retirement deduction of 3½ per cent.

Competitors will not be required to report for a written examination, but will be rated on their education and experience. Applicants must have had certain specified education and experience. Full information may be obtained from the Secretary of the United States Civil Service Board of Examiners at the post office or customhouse in any city, or from the United States Civil Service Commission, Washington, D. C.

PAVING WITH JUTE.—The municipality of Prague, Czechoslovakia, is experimenting with the use of jute for paving city streets.

State Gasoline Taxes and Motor Vehicle Registrations

STATE GASOLINE RECEIPTS.—State gasoline taxes for 1932, according to figures compiled by the U. S. Bureau of Public Roads, totaled \$514,138,190. The net total gallons taxed was 14,250,173,296, a decrease of 7.5 per cent from 1931. The weighted average rate per gallon was 3.6 cts. The disposition of the receipts from the gas tax was as follows:

Collection and administration cost.....	\$ 2,832,820
Construction and maintenance of rural roads.....	301,788,231
Local roads	94,073,954
State and county road bond payments.....	50,726,362
On city streets.....	16,776,050
Other than highway purposes.....	47,941,483

The total number of motor vehicles registered in 1932, according to figures compiled by the U. S. Bu-



The Shot for Shoulder Shooting

reau of Public Roads, was 24,136,879, of which 20,903,422 were passenger automobiles, taxis and busses and 3,233,457 were motor trucks and road tractors. In addition, 412,998 trailers and 91,296 motorcycles were registered. The total gross receipts were \$324,273,510. The disposition of the gross receipts was as follows:

Collection and administration.....	\$ 17,550,422
State highways	155,911,962
Local roads	75,964,336
State and county road bonds.....	39,339,980
Other purposes	35,566,810

CONTROL OF WEST VIRGINIA STATE AND COUNTY DISTRICT ROADS CENTRALIZED.—A new road law was passed May 16 by the West Virginia legislature, which centralizes the control of all state and county-district roads under a one-man commissioner to be named. The bill, as generally interpreted, will make drastic changes in the personnel of the county departments. County engineering departments are eliminated in its provision after July 1, 1933.

Public Works Section of National Recovery Act

THE National Industrial Recovery Act, congressional action on which was completed June 13, when the Senate approved the Conference Report, and which was signed by President Roosevelt a few days later, has for its purpose: "to encourage national industrial recovery, to foster fair competition and to provide for the construction of certain useful public work." The public works and construction projects section, for which an appropriation of \$3,300,000,000 is provided, is Title II of the act. The text of this section, omitting the taxation provisions, follows:

TITLE II—PUBLIC WORKS AND CONSTRUCTION PROJECTS

Federal Emergency Administration of Public Works

Section 201. (a) To effectuate the purposes of this title, the President is hereby authorized to create a Federal Emergency Administration of Public Works, all the powers of which shall be exercised by a Federal Emergency Administrator of Public Works (hereafter referred to as the "Administrator"), and to establish such agencies, to accept and utilize such voluntary and uncompensated services, to appoint without regard to the civil service laws, such officers and employees, and to utilize such Federal officers and employees, and, with the consent of the State, such State and local officers and employees as he may find necessary, to prescribe their authorities, duties, responsibilities, and tenure, and, without regard to the Classification Act of 1923, as amended, to fix the compensation of any officers and employees so appointed. The President may delegate any of his functions and powers under this title to such officers, agents, and employees as he may designate or appoint.

(b) The Administrator may, without regard to the civil service laws or the Classification Act of 1923, as amended, appoint and fix the compensation of such experts and such other officers and employees as are necessary to carry out the provisions of this title; and may make such expenditures (including expenditures for personal services and rent at the seat of government and elsewhere, for law books and books of reference, and for paper, printing, and binding) as are necessary to carry out the provisions of this title.

(c) All such compensation, expenses, and allowances shall be paid out of funds made available by this Act.

(d) After the expiration of two years after the date of the enactment of this Act, or sooner if the President shall by proclamation of the Congress shall by joint resolution declare that the emergency recognized by section 1 has ended, the President shall not make any further loans or grants or enter upon any new construction under this title, and any agencies established hereunder shall cease to exist and any of their remaining functions shall be transferred to such departments of the Government as the President shall designate: *Provided*, That he may issue funds to a borrower under this title prior to January 23, 1939, under the terms of any agreement, or any commitment to bid upon or purchase bonds, entered into with such borrower prior to the date of termination, under this section, of the power of the President to make loans.

Sec. 202. The Administrator, under the direction of the President, shall prepare a comprehensive program of public works, which shall include among other things the following: (a) Construction, repair, and improvement of public highway and park ways, public buildings, and any publicly owned instrumentalities and facilities; (b) conservation and development of natural resources, including control, utilization, and purification of waters, prevention of soil or coastal erosion, development of water power, transmission of electrical energy, and construction of river and harbor improvements and flood control, and also the construction of any river or drainage improvement required to perform or satisfy any obligation incurred by the United States through a

treaty with a foreign Government heretofore ratified and to restore or develop for the use of any State or its citizens water taken from or denied to them by performance on the part of the United States of treaty obligations heretofore assumed: *Provided*, That no river or harbor improvements shall be carried out unless they shall have heretofore or hereafter been adopted by the Congress or are recommended by the Chief of Engineers of the United States Army; (c) any projects of the character heretofore constructed or carried on either directly by public authority or with public aid to serve the interests of the general public; (d) construction, reconstruction, alteration, or repair under public regulation or control of low-cost housing and slum-clearance projects; (e) any project (other than those included in the foregoing classes) of any character heretofore eligible for loans under subsection (a) of section 201 of the Emergency Relief and Construction Act of 1932, as amended, and paragraph (3) of such subsection (a) shall for such purposes be held to include loans for the construction or completion of hospitals the operation of which is partly financed from public funds, and of reservoirs and pumping plans and for the construction of dry docks and if in the opinion of the President it seems desirable, the construction of naval vessels within the terms and/or limits established by the London Naval Treaty of 1930 and of aircraft required therefor and construction of heavier-than-air aircraft and technical construction for the Army Air Corps and such Army housing projects as the President may approve, and provision of original equipment for the mechanization or motorization of such Army tactical units as he may designate: *Provided, however*, That in the event of an international agreement for the further limitation of armament, to which the United States is signatory, the President is hereby authorized and empowered to suspend, in whole or in part, any such naval or military construction or mechanization and motorization of Army units: *Provided, further*, That this title shall not be applicable to public works under the jurisdiction or control of the Architect of the Capitol or of any commission or committee for which such Architect is the contracting and/or executive officer.

Sec. 203. (a) With a view to increasing employment quickly (while reasonably securing any loans made by the United States) the President is authorized and empowered through the Administrator or through such other agencies as he may designate or create, (1) to construct, finance, or aid in the construction or financing of any public-works project included in the program prepared pursuant to section 202; (2) upon such terms as the President shall prescribe, to make grants to States, municipalities, or other public bodies for the construction, repair, or improvement of any such project, but no such grant shall be in excess of 30 per centum of the cost of the labor and materials employed upon such project; (3) to acquire by purchase, or by exercise of the power of eminent domain, any real or personal property in connection with the construction of any such project, and to sell any security acquired or any property so constructed or acquired or to lease any such property with or without the privilege of purchase; *Provided*, That all moneys received from any such sale or lease or the repayment of any loan shall be used to retire obligations issued pursuant to section 209 of this Act, in addition to any other moneys required to be used for such purpose; (4) to aid in the financing of such railroad maintenance and equipment as may be approved by the Interstate Commerce Commission as desirable for the improvement of transportation facilities; and (5) to advance, upon request of the Commission having jurisdiction of the project, the unappropriated balance of the sum authorized for carrying out the provisions of the Act entitled "An Act to provide for the construction and equipment of an annex to the Library of Congress," approved June 13, 1930 (46 Stat. 583); such advance to be expended under the direction of such Commission and in accordance with such Act: *Provided*, That in deciding to extend any aid or grant hereunder to any State, county, or municipality the President may consider whether action is in process or in good faith assured therein reasonably designed to bring the ordinary current expenditures thereof

within the prudently estimated revenues thereof. The provisions of this section and section 202 shall extend to public works in the several States, Hawaii, Alaska, the District of Columbia, Puerto Rico, the Canal Zone, and the Virgin Islands.

(b) All expenditures for authorized travel by officers and employees, including subsistence, required on account of any Federal public-works projects, shall be charged to the amounts allocated to such projects, notwithstanding any other provisions of law; and there is authorized to be employed such personal services in the District of Columbia and elsewhere as may be required to be engaged upon such work and to be in addition to employes otherwise provided for, the compensation of such additional personal services to be a charge against the funds made available for such construction work.

(c) In the acquisition of any land or site for the purposes of Federal public buildings and in the construction of such buildings provided for in this title, the provisions contained in sections 305 and 306 of the Emergency Relief and Construction Act of 1932, as amended, shall apply.

(d) The President, in his discretion, and under such terms as he may prescribe, may extend any of the benefits of this title to any State, county, or municipality notwithstanding any constitutional or legal restriction or limitation on the right or power of such State, county, or municipality to borrow money or incur indebtedness.

Sec. 204. (a) For the purpose of providing for emergency construction of public highways and related projects, the President is authorized to make grants to the highway departments of the several States in an amount not less than \$400,000,000, to be expended by such departments in accordance with the provisions of the Federal Highway Act, approved November 9, 1921, as amended and supplemented, except as provided in this title, as follows:

(1) For expenditure in emergency construction on the Federal aid highway system and extensions thereof into and through municipalities. The amount apportioned to any State under this paragraph may be used to pay all or any part of the cost of surveys, plans, and of highway and bridge construction including the elimination of hazards to highway traffic, such as the separation of grades at crossing, the reconstruction of existing railroad grade crossing structures, the relocation of highways to eliminate railroad crossings, the widening of narrow bridges and roadways, the building of footpaths, the replacement of unsafe bridges, the construction of routes to avoid congested areas, the construction of facilities to improve accessibility and the free flow of traffic, and the cost of any other construction that will provide safer traffic facilities or definitely eliminate existing hazards to pedestrian or vehicular traffic. No funds made available by this title shall be used for the acquisition of any land, right of way, or easement in connection with any railroad grade elimination project.

(2) For expenditure in emergency construction on secondary or feeder roads to be agreed upon by the State highway departments and the Secretary of Agriculture: *Provided*, That the State or responsible political subdivision shall provide for the proper maintenance of said roads. Such grants shall be available for payment of the full cost of surveys, plans, improvement, and construction of secondary or feeder roads, on which projects shall be submitted by the State highway department and approved by the Secretary of Agriculture.

(b) Any amounts allocated by the President for grants under subsection (a) of this section shall be apportioned among the several States, seven-eighths in accordance with the provisions of section 21 of the Federal Highway Act, approved November 9, 1921, as amended and supplemented (which Act is hereby further amended for the purposes of this title to include the District of Columbia), and one-eighth in the ratio which the population of each State bears to the total population of the United States, according to the latest decennial census, and shall be available on July 1, 1933, and shall remain available until expended; but no part of the funds apportioned to any State need be matched by the State, and such funds may also be used in lieu of State funds to match unobligated balances of previous apportionments of regular Federal-aid appropriations.

(c) All contracts involving the expenditure of such grants shall contain provisions establishing minimum rates of wages, to be predetermined by the State highway department, which contractors shall pay to skilled and unskilled labor, and such minimum rates shall be stated in the invitation for bids and shall be included in proposals for bids for the work.

(d) In the expenditure of such amounts, the limitations in the Federal Highway Act, approved November 9, 1921, as amended and supplemented, upon highway construction, reconstruction, and bridges within municipalities and upon payments per mile which may be made from Federal funds, shall not apply.

(e) As used in this section the term "State" includes the Territory of Hawaii and the District of Columbia. The term "highway" as defined in the Federal Highway Act approved November 9, 1921, as amended and supplemented, for the purposes of this section, shall be deemed to include such main parkways as may be designated by the State and approved by the Secretary of Agriculture as part of the Federal-aid highway system.

(f) Whenever, in connection with the construction of any highway project under this section or section 202 of this Act, it is necessary to acquire rights of way over or through any property or tracts of land owned and controlled by the Government of the United States, it shall be the duty of the proper official of the Government of the United States having control of such property or tracts of land with the approval of the President and the Attorney General of the United States, and without any expense whatsoever to the United States, to perform any acts and to execute any agreements necessary to grant the rights of way so required, but if at any time the land or the property the subject of the agreement shall cease to be used for the purposes of the highway, the title in and the jurisdiction over the land or property shall automatically revert to the Government of the United States and the agreement shall so provide.

(g) Hereafter in the administration of the Federal Highway Act, and Acts amendatory thereof or supplementary thereto, the first paragraph of section 9 of said Act shall not apply to publicly owned toll bridges or approaches thereto, operated by the highway department of any State, subject, however, to the condition that all tolls received from the operation of any such bridge, less the actual cost of operation and maintenance, shall be applied to the repayment of the cost of its construction or acquisition, and when the cost of its construction or acquisition shall have been repaid in full, such bridge thereafter shall be maintained and operated as a free bridge.

Sec. 205. (a) Not less than \$50,000,000 of the amount made available by this Act shall be allotted for (A) national forest highways, (B) national forest roads, trails, bridges, and related projects, (C) national park roads and trails in national parks owned or authorized, (D) roads on Indian reservations, and (E) roads through public lands, to be expended in the same manner as provided in paragraph (2) of section 301 of the Emergency Relief and Construction Act of 1932, in the case of appropriations allocated for such purposes, respectively, in such section 301, to remain available until expended.

(b) The President may also allot funds made available by this Act for the construction, repair, and improvement of public highways in Alaska, the Canal Zone, Puerto Rico, and the Virgin Islands.

Sec. 206. (a) All contracts let for construction projects and all loans and grants pursuant to this title shall contain such provisions as are necessary to insure (1) that no convict labor shall be employed on any such project; (2) that (except in executive, administrative, and supervisory positions), so far as practicable and feasible, no individual directly employed on any such project shall be permitted to work more than thirty hours in any one week; (3) that all employees shall be paid just and reasonable wages which shall be compensation sufficient to provide, for the hours of labor as limited, a standard of living in decency and comfort; (4) that in the employment of labor in connection with any such project, preference shall be given where they are qualified, to ex-service men with dependents, and then in the following order: (A) To citizens of the United States and aliens who have declared their intention of becoming citizens, who are bona fide residents of the political subdivision and/or county in which the work is to be performed, and (B) to citizens of the United States and aliens who have declared their intention of becoming citizens, who are bona fide residents of the State, Territory, or District in which the work is to be performed: *Provided*, That these preferences shall apply only where such labor is available and qualified to perform the work to which the employment relates; and (5) that the maximum of human labor shall be used in lieu of machinery wherever practicable and consistent with sound economy and public advantage.

Sec. 207. (a) For the purpose of expediting the actual construction of public works contemplated by this title and to provide

a means of financial assistance to persons under contract with the United States to perform such construction, the President is authorized and empowered, through the Administrator or through such other agencies as he may designate or create, to approve any assignment executed by any such contractor, with the written consent of the surety or sureties upon the penal bond executed in connection with his contract, to any national or State bank, or his claim against the United States, or any part of such claim, under such contract; and any assignment so approved shall be valid for all purposes, notwithstanding the provisions of sections 3737 and 3477 of the Revised Statutes, as amended.

(b) The funds received by a contractor under any advances made in consideration of any such assignment are hereby declared to be trust funds in the hands of such contractor to be first applied to the payment of claims of subcontractors, architects, engineers, surveyors, laborers, and material men in connection with the project, to the payment of premiums on the penal bond or bonds, and premiums accruing during the construction of such project on insurance policies taken in connection therewith. Any contractor and any officer, director, or agent of any such contractor, who applies, or consents to the application of, such funds for any other purpose and fails to pay any claim or premium hereinbefore mentioned, shall be deemed guilty of a misdemeanor and shall be punished by a fine of not more than \$1,000 or by imprisonment for not more than one year, or by both such fine and imprisonment.

(c) Nothing in this section shall be considered as imposing upon the assignee any obligation to see to the proper application of the funds advanced by the assignee in consideration of such assignment.

Sec. 208. To provide for aiding the redistribution of the overbalance of population in industrial centers \$25,000,000 is hereby made available to the President, to be used by him through such agencies as he may establish and under such regulations as he may make, for making loans for and otherwise aiding in the purchase of subsistence homesteads. The moneys collected as repayment of said loans shall constitute a revolving fund to be administered as directed by the President for the purposes of this section.

Rules and Regulations

Sec. 209. The President is authorized to prescribe such rules and regulations as may be necessary to carry out the purposes of this title, and any violation of any such rule or regulation shall be punishable by fine of not to exceed \$500 or imprisonment not to exceed six months, or both.

Issue of Securities and Sinking Fund

Sec. 210. (a) The Secretary of the Treasury is authorized to borrow, from time to time, under the Second Liberty Bond Act, as amended, such amounts as may be necessary to meet the expenditures authorized by this Act, or to refund any obligations previously issued under this section, and to issue therefor bonds, notes, certificates of indebtedness, or Treasury bills of the United States.

(b) For each fiscal year beginning with the fiscal year 1934 there is hereby appropriated, in addition to and as part of, the cumulative sinking fund provided by section 6 of the Victory Liberty Loan Act, as amended, out of any money in the Treasury not otherwise appropriated, for the purpose of such fund, an amount equal to $2\frac{1}{2}$ per centum of the aggregate amount of the expenditures made out of appropriations made or authorized under this Act as determined by the Secretary of the Treasury.

UNIFORM LEGISLATION FOR TRUCKS.—Representatives of twelve states and the District of Columbia will meet at Harrisburg, Pa., in October to consider the practicability of reciprocal and uniform legislation and regulation of size, weight, height and length of motor vehicles transporting passengers and freight. The conference will be conducted by the American Legislators' Association, which has called it in response to a request by the Pennsylvania legislature. The participating representatives will be from the states of Maine, New Hampshire, Massachusetts, Vermont, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Delaware, Ohio, Indiana, Illinois, West Virginia, Virginia and the District of Columbia.

Relief Men on County Road Work

In two years use of relief men on "made work" Marion County highway department benefited by approximately 1,000,000 man-hours of work, according to a paper presented by Charles Mann, County Highway Superintendent at the 1933 Purdue Road School.

The idea was to provide work on public projects, wholly outside of regular budgets, but for useful purposes. These men were furnished by the various township trustees. They worked from one to four days of eight hours each per week, depending upon the amount of relief work required by each individual.

These men were used in cleaning out roadside ditches, shaping up berms, cutting bushes, widening curves, shoveling gravel, constructing new roads, opening drainage ditches, etc. A large amount of work was accomplished that would not otherwise have been undertaken. An analysis of several thousand of these workers showed that half were white and half negroes, a majority being 36 to 40 years of age, ranging from 17 to 86 years of age. The industries represented by these men were as follows:

	Per Cent.
Building and construction.....	38.4
Metal and machinery.....	22.5
Transportation and public utilities.....	15.7
Clerical, professional, technical.....	5
Woodworking and furniture.....	3.5
Foods industries	3.1
Agriculture	1.3
Miscellaneous	10.5

Truck Mileage and Gas Consumption

In connection with studies in Wisconsin of expenditures for highway purposes statistics were collected on average mileage traveled and gasoline consumption by automobiles. These figures showed that the motor-truck mileage for the state as a whole averaged 9,002 miles, which was 23 per cent above the average number of miles traveled by automobiles. In each of the ownership classifications, the motor truck was used on the average to a greater degree than the automobile, except in Milwaukee. In Milwaukee, the average miles traveled by automobiles were 9,370, and the average truck mileage was 9,027.

The average gasoline consumption, according to this investigation, amounted to 563 gals. per motor vehicle; for automobiles, the average was 520; and for motor trucks it was 851. The average consumption of gasoline for motor trucks exceeded that of automobiles by 64 per cent; the average mileage of motor trucks exceeded that of automobiles by only 23 per cent. This difference was accounted for by the fact that the automobiles averaged 14.1 miles per gallon of gasoline, and the motor trucks averaged only 10.6 miles.

The average yearly consumption of 563 gal. of gasoline by motor vehicles operating 12 months in 1930 was the weighted average used by those owned in towns, 409 gal.; in villages, 600 gal.; in cities other than Milwaukee, 675 gal.; and in Milwaukee, 734 gal. The average mileage per gal. for all motor vehicles was 13.4 miles.

NEW STATE HIGHWAY ENGINEER FOR WYOMING.—C. H. Bowman, District Engineer State Highway Department of Wyoming, has been appointed State Highway Engineer, succeeding Z. S. Levison, who retired on June 1 after serving more than 16 years in that position. Levison will remain with the department temporarily as consulting engineer.

SPECIAL PROVISIONS

for Highway Projects Under Public Works Bill

SPECIAL provisions for highway projects to apply on Federal aid construction under the National Industrial Recovery Act were issued on June 29 by Thomas H. MacDonald, Chief, Bureau of Public Works. These provisions are supplementary to the "Rules and Regulations—Emergency Highway Construction," which are printed elsewhere in this issue. In his introduction to the Special Provisions, Mr. MacDonald states:

"In accordance with the regulations for the administration of funds apportioned to the States for the Emergency Construction of Highways by the National Industrial Recovery Act, the special provisions hereinafter given shall be added to the specifications for each project undertaken in whole or in part with such funds. They are grouped under two major divisions, viz., Required Special Provisions and Optional Provisions. The Required Special Provisions, or such parts thereof as apply to the particular types of construction involved, shall supplement the specifications for each and every project submitted. The Optional Special Provisions respecting hours of employment may be used only in meeting the conditions described in the explanatory notes respecting such provisions. On specially selected projects which offer opportunity to provide additional employment consistent with sound economy and public advantage, the State Highway Department, with the approval of the Bureau, may add to the Required Special Provisions any or all of the Optional Special Provisions for hand labor methods.

"Special provisions of any other character proposed by a State Highway Department to meet occasional and unusual conditions will be considered on their merit."

REQUIRED SPECIAL PROVISIONS

I. Employment Lists.

A local employment service or agency will be designated by the United States Employment Service to prepare the employment lists for the project. The contractor will be advised at or prior to the time of the award of the contract of the exact designation and location of the agency selected for this purpose; and the name and location of such agency shall be inserted in the contract.

II. Subletting or Assigning the Contract.

The contractor shall perform with his own organization and with the assistance of workmen under his immediate superintendence, work of a value not less than 80 per cent of the value of all work embraced in the contract exclusive of items not commonly found in contracts for similar work, or which require highly specialized knowledge, craftsmanship and/or equipment not ordinarily available in the organizations of contractors performing work of the character embraced in the contract.

No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer or his authorized representative. Requests for permission to sublet, assign or otherwise dispose of any portion of the contract shall be in writing and accompanied by a showing that the organization which will perform the work is particularly experienced and equipped for such work. The contractor shall give assurance that the minimum wage for unskilled labor and the maximum amount to be deducted for board, if furnished, as stated in his proposal shall apply to labor performed on all work sublet, assigned or otherwise disposed of in any way. Written consent to sublet, assign or otherwise dispose of any portion of the contract shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract.

III. Domestic Materials.

The contractor hereby warrants that all unmanufactured articles, materials, and supplies offered herein have been mined or produced in the United States, and that all manufactured

articles, materials and supplies offered have been manufactured in the United States substantially all from articles, materials or supplies mined, produced or manufactured, as the case may be, in the United States, unless articles, materials or supplies of the class or kind to be used, or the articles, materials or supplies from which they are manufactured are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality. It has been determined with respect to asphaltic materials for highway purposes that it is impracticable to apply the above requirements.

Preference shall be given of the use of materials produced under codes of fair competition as authorized under the National Industrial Recovery Act.

IV. Selection of Labor.

Preference in the employment of all labor, skilled and unskilled, shall be given to qualified ex-service men with dependents.

All labor, skilled and unskilled, shall be employed from lists of available and qualified persons furnished the contractor by the employment agency designated in the contract, provided however, that qualified ex-service men with dependents and employees in an executive, administrative or supervisory capacity may be employed without reference to such lists.

Whenever the contractor shall require labor he shall inform the designated employment agency of the number of laborers required for his needs and request a list of names from which he may select those necessary to meet his requirements. Should the employment agency at such times fail to supply a properly prepared list containing a number of names at least 25 per cent in excess of the indicated requirements of the contractor, giving the name, residence, age and previous occupation of each person, grouped in accordance with preference to (1) ex-service men with dependents; (2) citizens of the United States and aliens who have declared their intention of becoming citizens, who are bona fide residents of the political subdivision and/or county in which the work is to be performed; and (3) citizens of the United States and aliens who have declared their intention of becoming citizens, who are bona fide residents of the State, Territory or District in which the work is to be performed, within forty-eight hours after the receipt of such request, the contractor may employ any available labor to meet his immediate requirements, provided, however, that when qualified the order of preference in employment stated in this paragraph shall apply. This above procedure shall obtain for each successive requirement of labor.

Any skilled or unskilled laborer found to be incompetent may be discharged but replacement shall be made from lists furnished by the employment agency, when such lists are available.

No skilled or unskilled laborer obtaining employment through the preference established herein and performing work satisfactory to the contractor shall be displaced because of any preference in employment which develops subsequent to his employment.

V. Wages, Hours of Employment and Conditions of Employment.

Executive or administrative employees shall include the contractor, superintendents, timekeepers, bookkeepers, clerical employees, storekeepers, or other office employees in a position of special trust and responsibility.

Supervisory employees shall include foremen, master mechanics, or any employees whose principal duties are to direct the work of others.

Skilled laborers shall include all persons employed as operators of power-driven equipment (other than passenger automobiles, and trucks of not more than 1½ tons rated capacity), carpenters, masons, blacksmiths, mechanics and all other persons employed at work requiring principally the use of special tools ordinarily used by persons skilled in particular trades. Any subcontractor, who operates equipment, or who works with the tools of any trade shall be considered a skilled laborer for the time engaged in such work.

Unskilled labor shall include all labor not coming under the above classification. Watchmen, guards and waterboys shall be considered as unskilled laborers.

The minimum wage paid to all skilled labor employed on this contract shall be per hour, unless other minimum wages

are set forth herein for particular classes of skilled labor, in which event such minimum wages shall be paid to the respective classes of labor.

The minimum wages paid to all unskilled labor employed on this contract shall be per hour.

The wages of all skilled and unskilled labor shall be paid in legal tender of the United States.

Skilled and unskilled labor shall not be permitted to work more than 30 hours in any one week, except that working time lost because of inclement weather or shutdowns during the period of employment in any one week may be made up during the succeeding week or weeks of any one calendar month. The above limitation as qualified shall not apply to the operators of the following types of equipment, viz.: Power shovels, power cranes, concrete paving mixers and dredging machinery, nor to skilled labor engaged on the following classes of work where exceptional skill is required to secure uniformly smooth road surfaces, viz.: Master concrete finishers, master formsetters and blade grader operators for bituminous surfaces and on bases for such surfaces, unless skilled labor qualified to perform such duties can be obtained from the employment lists furnished by the designated employment agency; provided, however, that employment for such classes of skilled labor shall in all cases be limited to not more than eight hours in any one day and not more than 40 hours in any one week.

These provisions shall apply to:

Roadside production of materials, whether by subcontract or otherwise.

All hauling of material from roadside quarries and pits, from railroad or water delivery points, or from local sources of production to the site of the work, whether the work be done by the contractor or by a subcontractor.

Concrete proportioning plants, from which material is used wholly on this contract or on contracts under the supervision of this Department.

The provisions relating to hours of employment shall not apply to camp help; i. e., cooks, cooks' helpers, hostlers and stablemen.

The minimum wages specified herein shall be exclusive of any charges for medical examination or insurance. No individual employed on the project in other than an administrative position shall be paid less than the minimum rate for unskilled labor.

Copies of all pay rolls for work performed under this contract (whether done by the contractor or under a subcontract, or otherwise), certified under oath by the contractor or his authorized representative, shall be filed with the engineer, showing the name of each employee, the State and the county of his bona fide residence, the agency from which his name was obtained, whether or not a veteran with dependents, the class of work performed, the hours worked each day, the wage rate paid, the total amount earned and deductions for board, if any.

The pay rolls shall be divided into three sections under which shall be appropriately grouped (1) Executive, administrative and supervisory employees; (2) Skilled labor; and (3) Unskilled labor. Pay rolls shall be submitted for each calendar month (or part thereof) not later than the fifth day of the following month. Deviations from this procedure will not be permitted. The contractor's time books shall be open to the inspection of the engineer at any time.

Where camps are operated by the contractor, or by persons affiliated with the contractor, a deduction on the pay roll of more than per week (or day) for board and lodging will be considered a violation of the minimum wage specified herein. No deduction from the wages of any skilled or unskilled laborer shall be made on account of goods purchased or obligations incurred in any commissary or store owned, leased or otherwise controlled by the contractor. Obligations so incurred shall be subject to collection only in the same manner in which obligations in the ordinary course of business are collectible. Charges in excess of a fair market price for goods purchased from stores owned, leased, or otherwise controlled by the contractor will not be permitted.

No fee of any kind shall be asked or accepted by the contractor or any of his agents from any person who obtains work on the project, nor shall any person be required to pay any fee to any other person or agency obtaining employment for him on the project.

No skilled or unskilled labor shall be charged for any tools used in performing their respective duties except for loss or damage thereto.

Every employee on the work covered by this contract shall be permitted to lodge, board and trade where he and with whom he elects, and neither the contractor nor his agents, nor his employees, shall directly or indirectly require as a condition of

employment that an employee shall lodge, board or trade at a particular place or with a particular person.

No charge shall be made for any transportation furnished by the contractor or his agents to any person employed on the work.

No individual shall be employed as a skilled or unskilled laborer on this contract except on a wage basis, but this shall not be construed to prohibit the rental of teams, trucks, or other equipment from individuals. No such rental agreement, or any charges for feed, gasoline, supplies, or repairs on account of such agreement, shall cause any deduction from the wages accruing to any employee.

All of the above provisions shall also apply where work is to be performed by piece work, station work or by subcontract. The minimum wage shall be exclusive of equipment rental on any equipment which the worker or subcontractor may furnish in connection with his work.

VI. Hand Labor Methods.

Clearing and Grubbing

All clearing and grubbing of timber less than 18 inches in diameter shall be done by hand labor or by team labor methods. The use of explosives will be permitted for loosening stumps.

Grading

All trimming of slopes in cuts and fills shall be done by hand labor methods.

Ditches shall be trimmed by hand labor or team labor methods.

Subgrading

All material windrowed between forms by the use of blade graders or subgrade planers shall be removed by hand labor methods.

Pipe and Underdrains

Trenches for pipe of 24-inch diameter or less, tile drains and similar structures shall be dug by hand labor or team labor methods. The use of explosives will be permitted where necessary.

Pipe of 24 inches diameter or less, except cast iron water pipe, shall be unloaded and placed by hand labor methods. The use of cranes, block and tackle, and any other equipment operated by hand labor or team power, will be permitted.

Backfilling of excavated material shall be done by hand labor or team labor methods.

Culverts and Masonry Structures and Small Bridges Up to 50-foot Span

Cement and reinforcing steel shall be unloaded by hand labor methods.

Aggregates shall be moved from the stock piles at the structure to the mixer by hand shovels, wheelbarrows, or carts, or other hand labor or team labor methods.

All carpenter and form work shall be done by hand labor methods. The use of steel forms, where allowed by the specifications, will be permitted.

Concrete shall be transported from the mixer to its place of use by carts or wheelbarrows. Chutes, where allowed in the specifications, will be permitted.

Finishing of structural concrete surfaces shall be done by hand rubbing, or other hand labor methods.

Curbs and Gutters

Subgrading for curbs and gutters shall be done by hand labor or team labor methods.

Concrete and its constituent materials shall be handled as specified under "Culverts and Masonry Structures and Small Bridges."

Guard Rails

All post holes shall be dug by hand labor methods.

Posts, where available in the quantity and quality required, shall be cut in the vicinity of the proposed work.

All painting shall be done without the use of mechanical equipment.

Drybound and Waterbound Bases (Macadam, Gravel, Limerock, Caliche, etc.) and Waterbound Surface Courses

All filler (dust, screenings, chips, sand, etc.) shall be spread by hand labor methods.

Filler shall be broomed into the surface by hand labor methods.

Surface Treatments, Retreads and Mixed in Place Types

Sweeping of roadway, where required, shall be done by hand labor or team labor methods.

Bituminous Macadam Surface Course

Sweeping and cleaning of the base course in preparation to receive the surface course, where necessary, shall be done by hand labor or team labor methods.

All Surface Courses

Sweeping and cleaning of the base course in preparation for reception of the surface course shall be done by hand labor or team labor methods.

Roadside Production of Crushed Stone and Gravel

Roadside production of crushed stone or gravel is construed to be production with portable or semi-portable crushing or screening plants established or reopened in the vicinity of the work for the purpose of supplying local material for a particular project or projects.

Earth stripping of quarries and gravel pits shall be done by hand labor or team labor methods. Trucks of not more than $1\frac{1}{2}$ tons rated capacity may be used for hauling.

Stone in the quarry shall be loaded by hand labor methods.

Large Bridges

All painting of steel work shall be done without the use of mechanical equipment.

Carpenter work and form work shall be done by hand labor methods and the use of mechanical saws will not be permitted at the bridge site. Electrical or mechanical drills shall not be used for boring holes in piles and forms at the bridge site.

VII. General.

Any violation of the spirit or the intent of the foregoing provisions shall render the contractor ineligible to bid upon any further work involving the use of "National Recovery Highway Funds."

A**OPTIONAL SPECIAL PROVISIONS****V. Wages, Hours of Employment and Conditions of Employment.**

(a) Skilled and unskilled labor shall not be permitted to work more than 130 hours in any one calendar month.

NOTE: The above clause limiting employment to 130 hours in any one calendar month may be substituted for the first sentence of the 30-hour week clause of Sec. V of the Required Special Provisions in cases where the State Highway Department has determined, with the approval of the District Engineer of the Bureau of Public Roads, that a sufficient amount of labor is not available in the immediate vicinity of the project properly to man the work and unemployment has been absorbed in the area of the work. Such projects, in general, will be those so distant from employment centers or sources that some labor would desire to board in the vicinity of the work while employed thereon.

(b) Skilled and unskilled labor shall not be permitted to work more than eight hours in any one day and not more than 40 hours in any one week.

NOTE: The above clause may be used in lieu of the 30-hour week clause of Sec. V of the Required Special Provisions only in cases where the location of the work is so remote or so inaccessible as to make it necessary to maintain camps for housing and boarding all of the labor employed on the work. This clause will not be approved in cases where camps are established as a matter of custom, or for convenience of operation. The necessity for the establishment of camps shall be determined by the State Highway Department and approved by the District Engineer of the Bureau of Public Roads and the Director of the United States Employment Service prior to the advertisement of any project, and in all such predetermined cases the above clause shall be stated in the advertisement and in the special provisions for such projects.

B**VI. Hand Labor Methods.****Grading**

Hand labor or team labor methods shall be used for excavating all earth material.

Team equipment or trucks of not more than $1\frac{1}{2}$ tons rated capacity shall be used for hauling excavated material.

Power excavating equipment and explosives may be used in rock excavation.

NOTE: The above clauses may be added to the Required Special Provisions for Grading, Sec. VI, on projects especially selected as being well adapted to hand labor and team labor methods. In general such projects will be those involving excavation at a rate not exceeding 12,000 cubic yards to the mile, or very short jobs such as bridge approaches or minor line revisions and improvements. These provisions may also be applied to certain continuous grading sections of heavy grading projects, not less than a mile in length, involving excavation, in such sections, at a rate not exceeding 12,000 cubic yards per mile.

Roadside Production of Crushed Stone and Gravel

The use of power shovels, clamshells and draglines will not be permitted in the production of gravel under the contract.

NOTE: This clause may be used whenever gravel may be produced with reasonable economy by the elimination of the above types of equipment.

Culverts and Masonry Structures and All Bridges

All excavation and backfilling shall be done by hand tools such as picks, shovels and wheelbarrows, or by team tools, such as scrapers and carts. The use of explosives will be permitted, also power operated pumps where necessary. Excavation more than 6 feet below normal ground level may be removed by mechanical means.

New Method of Wetting Earth Cover on Concrete Widening Strip

A new method of wetting down the earth cover on a 11-ft. concrete widening strip was developed by G. Y. Carpenter, Superintendent for McGuire & Roth, Contractors, Richmond, Va., in the reconstruction of the Washington-Richmond highway between Washington and Fredericksburg, Va., to a 30-ft. width.

An 1800-gal. standard gasoline tank was mounted on a 3-ton Brockaway truck driven by L. A. Payne, truck owner, and a 4-in. pipe, 12 ft. long, was connected at the side of the tank at the bottom. The bottom side of the pipe was drilled with $\frac{3}{8}$ -in. holes spaced 1 in., edge to edge. A control valve that could be operated from the cab of the truck by the driver was used for a time,



Arrangement for Wetting Earth Cover

but the rig was found to work satisfactorily without the control valve. A portable Jaeger gasoline water pump of 500 gal. per minute capacity was mounted on the truck behind the tank. This water pump was equipped with a long suction hose which was used to fill the tank from streams that cross the road, or from other sources of water supply.

The watering rig was used to wet the earth cover used in curing the 11-ft. widening strip of concrete at necessary intervals of time. The truck was driven along the concrete road with the watering pipe projecting over the strip of concrete to be cured and water applied as needed.

The equipment for watering was tried out first near Petersburg, Va., and it has been used with success and economy on the Washington-Fredericksburg highway on the section under construction by McGuire & Roth.

Simple Cardinal Principles for Roadside Drinking Fountains

By J. R. McDERMOTT

District Engineer, State Road Commission of West Virginia

PROVISION of suitable safe drinking water along the public highways is being recognized as a proper function of state government, either through its highway department alone or in cooperation with its department of public health. Among the measures taken are included sanitary control of municipal water systems, testing of private supplies to which the traveling public is invited to have free access, and the construction of public water supplies at practical points contiguous to the public highways, all of which facilities should be properly placarded for the information of the motorist when sanitation is assured. It is believed that the providing of public drinking fountains and their maintenance constitutes one of the finest legitimate forms of advertising possible for a state and for its state highway organization.

In mountainous country especially it is frequently possible to locate adequate sources of water with which to provide this meritorious service for the convenience of the motoring public. During the past year the writer had some limited experience in carrying forward such a program and believes that it may prove of interest to outline some of the simple cardinal principles followed. The illustrations show several 1932 projects and will serve to illustrate current practices.

A spring of suitable volume capable of being developed and protected is the essential prerequisite. Protection must be had both against contamination and against destructive vandalism. For this reason the source should best be at a distance of a few hundred feet from the highway. A spring located up to 2,000 ft. distance from roadside will not prove unduly expensive to pipe to the fountain site. Once both the palatability and the purity of the water are determined, arrangements for the supply must be consummated by purchasing or lease. Excellent cooperation may generally be secured from property owners by the exercise of proper diplomacy and frankness as to the intended purposes. The entire water supply should be captured at its source in a concrete or masonry box provided with a hinged locked lid to permit of ready access for inspection and cleaning, this lid to be watertight or so raised above the top level of the box as to prevent the entrance of water from above. All surface water must be ditched away from around the spring box to guard against contamination. From this box a feed line leads to the fountain and also a short overflow pipe to carry off surplus water. The immersed feed-pipe should have a down-turned pipe elbow and short nipple protected with a fine mesh copper screen through which the water may rise into the line, and for its entire length this pipe should be buried deeply to protect against winter frost and summer heat.

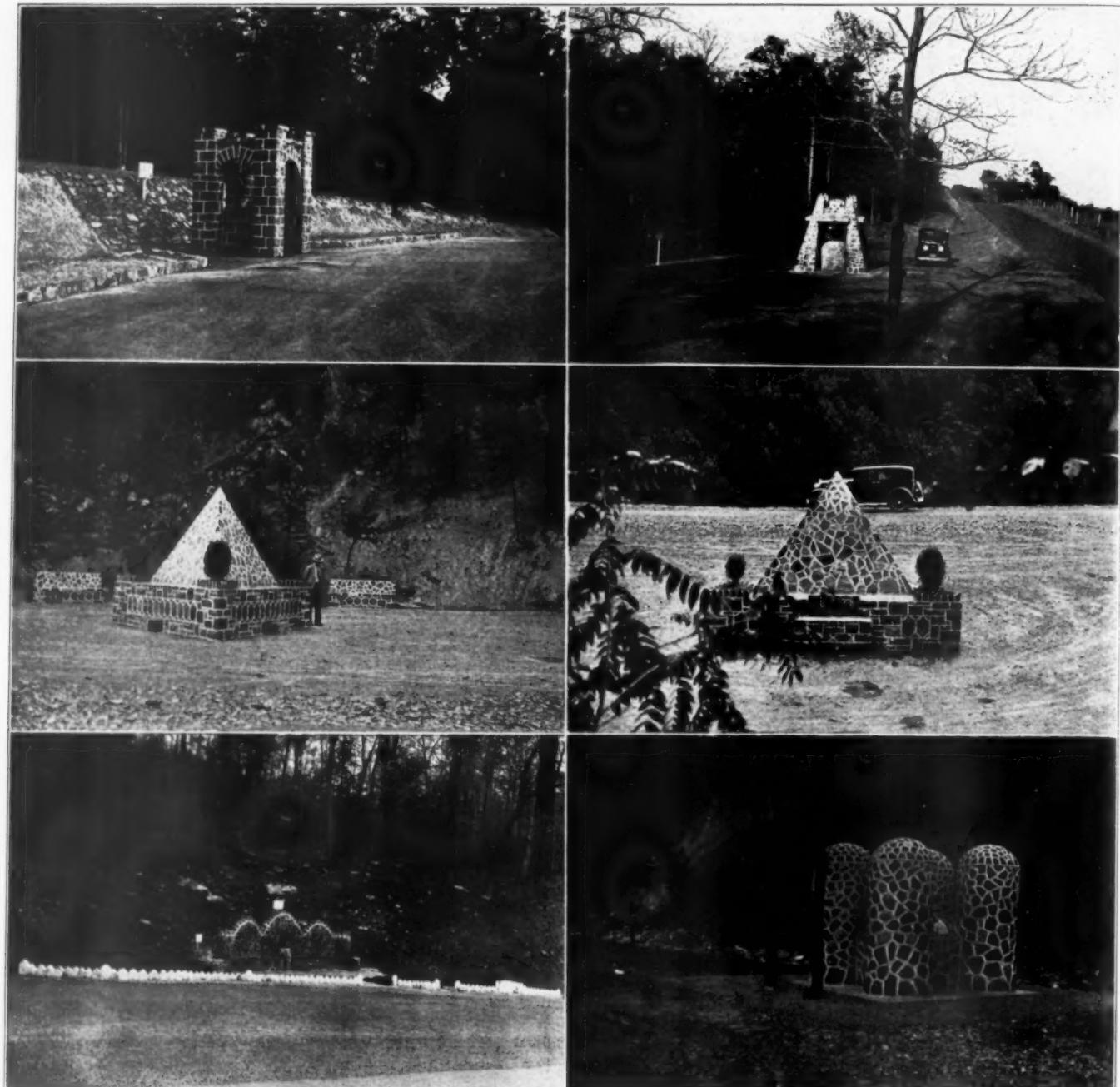
Granting the availability of the water, the fountain site should be selected among pleasant surroundings with

ample parking facilities and should be readily visible for a few hundred feet in either direction along the highway. Suitable shade and adjacent picnicking facilities are very desirable if practical. It is firmly believed that the offset distance from face of fountain to the outer edge of the nearest lane of the highway should be a minimum of 20 ft., thus providing at least two parking lanes entirely off the road surface. A single lane on each side is objectionable as it tends toward creating traffic confusion. In some instances it has proven both practical and desirable to provide for one or more lanes in the rear of the fountain in addition to the two front lanes.

Stone masonry using rock native to the vicinity appears to be the most attractive material for construction, as such work harmonizes with its setting. The design of the fountain is a matter of taste and may range from the simple to the elaborate, from the rustic to the finished, but should generally be both substantial and conservative. It should include provision for the direct refreshment of the patron, for filling of water containers, and for serving of the automobile. A highly satisfactory arrangement has proven to be two mouthpieces, one on either side, with a gooseneck pipe at the front or rear for bottle filling, the overflow from all openings leading into a small basin at the rear from which radiators may be filled or in which hands may be washed. The water should rise about 2 to 3 in. above the mouthpieces which should be at a height of about 42 in. above the ground. Unused water drips into a small splash basin 6 to 8 in. in depth with screened discharge so arranged that no water will be pooled in the basin.

An ideal water source should furnish sufficient water that continuous flow is had through all three discharge openings mentioned. If the supply is inadequate to provide for such continuous flow, fewer discharges may be provided or the mouthpieces may be equipped with hand valves of the automatic-closing type, or a self-closing faucet may be used on the bottle-filling pipe. Should the temperature of the water be too warm for palatability, the feed-line from the spring may lead into a deeply buried cooling tank or basin placed immediately adjacent to the fountain. All pipe fittings in and about the fountain should be of brass and so arranged that pressures may be independently controlled at each discharge opening. Valves for this purpose may be conveniently grouped within a small control box built into the masonry at the rear of the fountain with access to same through a securely locked but inconspicuously located hand-door.

Natural shade and shrubbery at and about the site should be carefully cultivated and preserved and native shrubs may be transplanted as desired, but artificial landscaping should be avoided. Needless to say, the surroundings must be systematically policed by the regular maintenance crew and in this particular a neatly painted, conveniently located trash receiver will prove of great value. A stone stepping-block placed at one or both of the drinking mouthpieces will be appreciated by the



Views of Roadside Drinking Fountains Along the Highways of West Virginia

Upper Left: The "Blue Ridge" Fountain on Route 23 in Jefferson County. Dressed Masonry of Dark Limestone and Miniature in Design. Gooseneck Discharges Into Splash Basin, Rear of Fountain. Paved Parking Area with Curbed Grass Plots. Picnicking Grove in Rear with View Overlooking the Valley of the Shenandoah

Upper Left: "Pin-Oak" Fountain on Route 29 in Hampshire County. Rough Field Boulders Trimmed with Fused Silica Crystals Found Locally, Resembling Stalagmites. A Good Example of Suitable Location Having Ample Parking Area with Shady Picnicking Grounds Adjacent. Race of Fountain to Edge of Roadway Is 30 Ft. Two Mouthpieces, Bottle Filling Gooseneck and Discharge Basin in Rear

Middle Left: The "Sinks" Fountain on Route 23 in Hardy County. A Triangular Base of Cut Limestone Surmounted by a Pyramid of Sandstone River Boulders. Has Two Drinking Nipples, One Above Each of the Stepping Blocks. Two Stone Seats at Rear of Parking Area, One of Which Is a Culvert Headwall. Stepping Stones Lead Up to Picnicking Grounds Overlooking the Fountain Side and Roadway

Middle Right: Rear View of "Sinks" Fountain from Picnic Ground. Bottle Filling Nipple Shown Discharging Into Basin. Control Box Located at Left of Basin with Hinged Door Near Ground Line. Parking Lanes Both Front and Rear Well Clear of Used Roadway

Lower Left: The "Johnny Cake" Fountain on U. S. Route 50 in Grant County. Native Sandstone Masonry with High-Backed Seats on Either Side of Central Fountain. Paved Three Lane Parking Area with Curbed Plot for Safety of Alighted Passengers. Being Located on a Grade, the Pool Is at a Lower Level, Having Separate Entrance from Parking Area and Steps from Curbed Area

Lower Right: "New Creek" Fountain on U. S. Route 50 in Mineral County. Creek Boulder Pillars Enclosing Rough Cut Limestone Base. Two Drinking Nipples at Sides and Bottle Filling Gooseneck at Rear. Located Between Creek and Highway and Guarded by Twin Elms, with Two Parking Lanes Between Trees and Road Edge

juvenile traveler. A small brass nameplate may be attached to the roadside face of the fountain, bearing the state seal and the year constructed. Suitable advance signs inform the motorist of the available facilities and

at the fountain a standard "safe drinking water" sign is prominently displayed, the accuracy of which information must be assured by periodic bacteriological tests of the water.

Rules and Regulations for Highway Work Under \$400,000,000 Federal Appropriation

RULES and regulations for carrying out the provisions of the National Industrial Recovery Act authorizing grants to the State highway departments for the emergency construction of public highways and related projects in accordance with the provisions of the Federal Highway Act were promulgated on June 23 by R. G. Tugwell, Acting Secretary of Agriculture. The \$400,000,000 appropriated by the act also was allotted on June 23 to the various states and the money will be available for expenditure July 1. The apportionment by state will be found on another page of this issue. The rules and regulations follow in full:

Section 1. The term "Act" as used herein shall be construed to mean those provisions of Title II of the National Industrial Recovery Act of June 16, 1933 (Public No. 67, 73rd Congress), which authorize the emergency construction of public highways and related projects in accordance with the provisions of the Federal Highway Act.

The term "State" as used herein shall include the Territory of Hawaii and the District of Columbia. The term "National Recovery Highway Funds" shall mean the four hundred million dollars of Federal funds authorized under Section 204 of the Act of June 16, 1933 (Public No. 67, 73rd Congress), to be granted to the several State Highway departments for the construction of public highways and related projects on the Federal-aid highway system and on extensions thereof into and through municipalities and on secondary or feeder roads in accordance with the provisions of the Federal Highway Act. All projects located on the Federal-aid highway system outside of municipalities involving the use of such funds shall be designated "National Recovery Highway Projects," indicated by prefixing the letters "NRH" to the project number. All projects located on extensions of the Federal-aid highway system into and through municipalities involving the use of such funds shall be designated "National Recovery Municipal Highway Projects," indicated by prefixing the letters "NRM" to the project number. All projects located on secondary or feeder roads involving the use of such funds shall be designated "National Recovery Secondary Highway Projects," indicated by prefixing the letters "NRS" to the project number.

Projects to Be Initiated by States

Sec. 2. All projects under this Act shall be initiated by the States and submitted in the same manner as other Federal-aid projects, and all such projects shall be subject to all provisions of the Rules and Regulations of the Secretary of Agriculture for administering the Federal Highway Act, as heretofore promulgated, except such provisions as are in conflict with these rules and regulations.

Sec. 3. Secondary or feeder roads, as referred to in this Section of the Act, shall be defined as roads which are not now included in the approved system of Federal-aid highways, but which are either part of the State highway system or are important local highways leading to shipping points, or which will permit the co-ordination or extension of existing transportation facilities, including highway, rail, air and water.

Apportionment of Funds

Sec. 4. Not more than 50 per cent of the funds apportioned to any State under this Act shall be applied to projects on the Federal-aid highway system outside of the corporate limits of municipalities; not less than 25 per cent of such funds shall be applied to projects on extensions of the Federal-aid highway system into and through municipalities; and not more than 25 per cent of such funds shall be applied to secondary or feeder roads until provision has been made for the satisfactory completion of at least 90 per cent of the initial limiting Federal-aid highway system in such State. Upon a proper showing by any State that, either all needed improvements on extensions of the Federal-aid highway system into and through municipalities can

be completed with an expenditure less than 25 per cent of the State's apportionment, or that municipal authorities are unable or unwilling to obtain the necessary rights of way for needed improvements, or for other reasons, the Secretary of Agriculture may revise the above percentages with reference to such State. The reconstruction of existing facilities that are adequate for traffic shall not be considered needed improvements.

Classes of Projects Enumerated

Sec. 5. Each State highway department shall submit for approval to the Secretary of Agriculture and through him to the Special Board for Public Works a preliminary statement showing the proposed assignment of the State's apportionment to (1) the Federal-aid highway system outside of municipalities, (2) extensions of the Federal-aid highway system into and through municipalities, and (3) secondary or feeder roads. This statement shall list the counties or political subdivisions in which projects to be submitted will be located. A project or projects of one or more of the defined classifications shall be provided in at least 75 per cent of all counties of the State, unless it be shown either (1) that the number of counties in which need of employment exists constitutes a smaller percentage of the total; or (2) that needed and suitable road construction projects cannot be found in that percentage of the total number of counties. In selecting counties in which projects are to be located, consideration shall be given to the relative need for employment in such counties.

Sec. 6. Upon approval of the preliminary statement in whole or in part each State highway department shall prepare and submit detailed programs of proposed construction of each of the three classes of projects enumerated in the foregoing Section, indicating the termini, the character of the work, the estimated cost, and the amount of Federal funds desired. The three programs may be submitted independently and may be so approved in whole or in part. In the selection of projects to be included in these programs priority shall be given to: (a) the closing of gaps in the Federal-aid highway system; (b) the appropriate landscaping of parkways or roadsides on a reasonably extensive mileage; (c) the correlating and supplementing of existing transportation facilities by road, rail, air and water, and providing of service to freight receiving stations, airports and emergency landing fields; (d) reconstruction designed to reduce maintenance cost and decrease future State and local highway expenditures; (e) providing a large number of small projects designed to employ the maximum of human labor; and (f) the elimination of hazards to highway traffic, such as the separation of grades at crossings, the reconstruction of existing railroad grade crossing structures, the relocation of highways to eliminate railroad crossings, the widening of narrow bridges and roadways, the building of footpaths, the replacement of unsafe bridges, the construction of routes to avoid congested areas, and the construction of facilities to improve accessibility and the free flow of traffic.

The Secretary and the Board reserve the right to require the construction of roads desired by the U. S. Railroad Coordinator to provide adequate year-round highway service in replacement of branch-line railroad service proposed to be abandoned.

Construction to Be Under Supervision State Highway Department

Sec. 7. Surveys and plans, specifications and estimates for all projects under this Act in each State shall be prepared under the immediate direction of the State highway department and the construction involved shall be under the immediate supervision of the State highway department. Funds apportioned under this Act shall not be available for the payment of any portion of the cost of surveys and plans undertaken prior to the approval of the program. Payment will be made of the actual itemized expenditures for surveys and plans on National Recovery Highway Projects and National Recovery Municipal Highway Projects only upon a showing by the State that the revenues available to the State for such purposes are insufficient to pay such costs. Payment may be made of the actual itemized cost of surveys and plans for National Recovery Secondary Projects. Payment may

be made of the actual itemized cost of construction engineering and inspection on all projects. Payment for engineering services will not be made on a percentage basis.

Each State shall maintain at its own expense a State highway department having adequate powers and suitably equipped and organized to discharge to the satisfaction of the Secretary of Agriculture the duties required by this Act and these rules and regulations. No part of the cost of surveys, plans, and engineering supervision of construction will be paid to any State which restricts employment of engineers on such work to residents of the State, unless it shall be shown that a sufficient number of qualified engineers, trained in highway construction, are available within the State.

Contractor to Furnish All Material

Sec. 8. All contracts for the construction of highways under this Act shall require the contractor to furnish all materials entering into the work, and no requirement shall be contained in any contract in any State providing price differentials for, or restricting the use of materials to, those produced within the State; provided, however, that preference shall be given to the use of materials produced under codes of fair competition approved under the National Industrial Recovery Act.

Sec. 9. No convict labor shall be employed and no materials manufactured or produced by convict labor shall be used on any project constructed under this Act.

Wage and Labor Requirements

Sec. 10. (a) All contracts for the construction of highways under this Act shall prescribe the minimum rates of wages as predetermined by the State highway department, which contractors shall pay to skilled and unskilled labor, and such minimum rates shall be stated also in the advertisement for bids and in proposals or bids which may be submitted. The wage rates so determined may be a minimum rate for unskilled labor and a minimum rate for skilled labor, or for skilled labor a minimum rate may be fixed for each class of such labor. Such wages shall be just and reasonable compensation sufficient to provide, for the hours of labor as limited, a standard of living in decency and comfort.

(b) All contracts for the construction of projects under this Act shall require that the wages of skilled and unskilled labor shall be paid in legal tender of the United States. All contracts for the construction of projects under this Act shall contain a provision that no deduction from the wages of skilled or unskilled labor shall be allowed on account of goods purchased or obligations incurred in any commissary or store owned, leased or otherwise controlled by the contractor. Obligations so incurred shall be subject to collection only in the same manner in which obligations incurred in the ordinary course of business are collectible.

Sec. 11. Contracts for all projects under this Act shall contain stipulations that in the employment of labor preference shall be given, where they are qualified, to ex-service men with dependents, and then in the following order: (a) to citizens of the United States and aliens who have declared their intention of becoming citizens, who are bona fide residents of the political subdivision and/or county in which the work is to be performed; and (b) to citizens of the United States and aliens who have declared their intention of becoming citizens, who are bona fide residents of the State in which the work is to be performed; provided that these provisions shall apply only where such labor is available and qualified to perform the work to which the employment relates.

30-Hour Working Week

Sec. 12. Contracts for all projects under this Act shall contain a stipulation that (except in executive, administrative and supervisory positions), so far as practicable and feasible, no individual shall be permitted to work more than thirty hours in any one week. This requirement shall be construed, (a) to permit working time lost because of inclement weather or unavoidable delays during the period of employment in any one week, to be made up in the succeeding week or weeks of any one calendar month; and (b) to permit a limitation of not more than 130 hours' work in any one calendar month to be substituted in the contract for the requirement of not more than 30 hours' work in any one week on projects in localities where a sufficient amount of labor is not available in the immediate vicinity of the work. It shall not be considered practicable and feasible to apply either of these limitations to work located at points so remote and so

inaccessible that camps are necessary for the housing and boarding of all of the labor employed on the work and unemployment has been absorbed in the area of the work, as determined by the State highway department with the approval of the District Engineer of the Bureau of Public Roads and the Director of the United States Employment Service prior to advertisement; provided, however, that in all such cases no individual shall be permitted to work more than 8 hours in any one day or more than 40 hours in any one week.

Sec. 13. In order to give effect to the provisions of this Act it will be required that the maximum of human labor be used in lieu of machinery wherever practicable and consistent with sound economy and public advantage.

Contractor to Furnish Copies of Pay Roll

Sec. 14. The specifications for each project shall contain special provisions which shall be in conformity with instructions issued by the Bureau of Public Roads for carrying into effect the stipulations required by these rules and regulations, which provisions shall include a requirement that the contractor shall promptly furnish to the State highway department copies of each pay roll certified under oath by the contractor or his authorized representative. Such copies shall be available for inspection by the Secretary of Agriculture and the Special Board for Public Works.

Sec. 15. Funds apportioned to the State highway departments for the emergency construction of highways under this Act may be used in lieu of State funds to match unobligated balances of previous apportionments of regular Federal-aid authorizations, and such regular Federal aid, so matched, may be used to the maximum extent legally permissible in the construction and reconstruction of projects on the Federal-aid highway system.

Sec. 16. All contracts for work to be done under these regulations shall provide the labor required for such projects and appropriately to be secured through local employment services shall be selected from qualified workers referred by employment agencies designated by the United States Employment Service. The State highway departments shall include the above-stated requirement in their contracts.

Sec. 17. All contracts for projects under this Act shall contain suitable stipulations designed to insure that not less than 80 per cent of the work embraced in the contract, exclusive of items not commonly found in contracts for similar work, or which require highly specialized knowledge, craftsmanship and/or equipment not ordinarily available in contracting organizations which perform work of the character embraced in the contract, shall be performed by the contractor with his own organization.

Requirements Regarding Materials

Sec. 18. All contracts for projects under this Act shall provide that in the performance of the work the contractor, subcontractors, material producers or suppliers shall use only such unmanufactured articles, materials and supplies as have been mined or produced in the United States, and only such manufactured articles, materials and supplies as have been manufactured in the United States substantially all from articles, materials or supplies mined, produced or manufactured, as the case may be, in the United States, unless articles, materials or supplies of the class or kind to be used, or the articles, materials or supplies from which they are manufactured are not mined, produced or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality; provided, however, that if a State highway department shall find that in respect to some particular articles, materials or supplies it is impracticable to make such requirement, or that it would unreasonably increase the cost, an exception, with the approval of the Bureau of Public Roads, shall be noted in the specifications as to those particular articles, materials or supplies, and a public record shall be made of the findings which justified the exception.

Sec. 19. Any work done by direct labor under this Act shall be subject to these rules and regulations. All materials used on such work shall be purchased under approved specifications on competitive bids after proper advertisement.

Sec. 20. No invitation for bids upon any project shall be advertised until the plans for such project have been recommended for approval by the District Engineer of the Bureau of Public Roads, and no contract for any such project shall be entered into, or award therefor made, by any State without prior concurrence in such action by the District Engineer of the Bureau of Public

Roads. Approval will not be given to any procedure or requirement designed to prevent the award of contracts to qualified contractors non-resident of the State in which the work is located.

Sec. 21. Project agreements for secondary or feeder road projects shall provide for the maintenance of such projects by the State where the law permits the State to undertake such maintenance; otherwise the State shall submit, in the form prescribed by the Secretary of Agriculture, an agreement with the county or other political subdivision for such maintenance.

Sec. 22. Project agreements for projects on extensions of the Federal-aid highway system into and through municipalities shall provide for the maintenance of such projects by the State where the law permits the State to undertake such maintenance; otherwise the State shall submit, in the form prescribed by the Secretary of Agriculture, an agreement with the municipality or other political subdivision for such maintenance.

Sec. 23. Any contractor who deliberately violates the spirit and intent of these rules and regulations or the special provisions issued thereunder shall not be eligible to bid upon any further work involving "National Recovery Highway Funds."

Sec. 24. No payments will be made to any State on account of work performed on any project which has not been done in accordance with these rules and regulations and the special provisions issued thereunder.

Sec. 25. These regulations shall apply to National Recovery Highway Projects, National Recovery Municipal Highway Projects and National Recovery Secondary Highway Projects as defined in Section 1 hereof.

\$400,000,000 Road Fund Apportioned Among States

Acting Secretary of Agriculture R. G. Tugwell on June 23 apportioned, with the approval of the Special Board for Public Works, Secretary of the Interior Harold L. Ickes, chairman, the \$400,000,000 appropriated by the National Industrial Recovery Act for expenditure on highway construction.

The money will be available for expenditure July 1 for construction of roads in the Federal aid highway system and extensions thereof into and through municipalities, and for the survey, planning, improvement and construction of secondary or feeder roads to be agreed upon by the state highways departments and the Secretary of Agriculture.

Allocation of the money has been made in accordance with the requirements of the act, which provide that seven-eighths of the total sum apportioned to the states shall be divided in accordance with the three-way plan established by the Federal highway act which gives equal weight to population, area, and rural post road mileage, and one-eighth in proportion to population. Sharing in the apportionment are the 48 states and Hawaii and the District of Columbia. In apportioning the seven-eighths part the states of Delaware, New Hampshire, Rhode Island and Vermont and Hawaii and the District of Columbia receive a minimum share of one-half of one per cent.

The amounts allocated follow:

State	Total Apportionment
Alabama	\$ 8,370,133
Arizona	5,211,960
Arkansas	6,748,335
California	15,607,354
Colorado	6,874,530
Connecticut	2,865,740
Delaware	1,819,088
Florida	5,231,834
Georgia	10,091,185
Idaho	4,486,249
Illinois	17,570,770
Indiana	10,037,843
Iowa	10,055,660
Kansas	10,089,604

Kentucky	7,517,359
Louisiana	5,828,591
Maine	3,369,917
Maryland	3,564,527
Massachusetts	6,597,100
Michigan	12,736,227
Minnesota	10,656,569
Mississippi	6,978,765
Missouri	12,180,306
Montana	7,439,748
Nebraska	7,828,961
Nevada	4,545,917
New Hampshire	1,909,839
New Jersey	6,346,039
New Mexico	5,792,935
New York	22,330,101
North Carolina	9,522,293
North Dakota	5,804,448
Ohio	15,484,592
Oklahoma	9,216,798
Oregon	6,106,896
Pennsylvania	18,891,004
Rhode Island	1,998,708
South Carolina	5,459,165
South Dakota	6,011,479
Tennessee	8,492,619
Texas	24,244,024
Utah	4,194,708
Vermont	1,867,573
Virginia	7,416,757
Washington	6,115,867
West Virginia	4,474,234
Wisconsin	9,724,881
Wyoming	4,501,327
District of Columbia	1,918,469
Hawaii	1,871,062

Rules and regulations for carrying out the work provided for by the funds apportioned were also promulgated by the Acting Secretary with approval of Mr. Ickes as chairman of the Public Works Board.

The rules and regulations define secondary or feeder roads as roads not now included in the Federal aid highway system, but which are either part of the state highway system or important local highways leading to shipping points, or which will permit co-ordination or extension of existing transportation facilities, including highway, rail, air, and water.

Not more than 50 per cent of the funds apportioned will be applied to projects on the Federal aid system outside of corporate limits. Not less than 25 per cent will be applied to extensions of the Federal aid system into and through municipalities, and not more than 25 per cent will be available for secondary or feeder roads until provision has been made for the satisfactory completion of at least 90 per cent of the initial limiting mileage of the Federal aid system, which is 7 per cent of the state's certified rural road mileage.

BICYCLE RESPONSIBLE FOR GOOD ROADS.—The Utica, N. Y., Press of April 6 contains the following interesting item: The bicycle is responsible for the present good roads which we enjoy in New York state today, according to the following story told by George C. Warren, general chairman of the highway sidewalks committee, American Society of Municipal Engineers. He says: "When I moved to Utica, N. Y., in 1888 there were very few reasonably smooth pavements in any city and anything more than a poorly graded and drained country road in any section. During that period the late Col. Albert A. Pope of Boston had perfected the bicycle which he first introduced into the United States from England. Everyone wanted one, but it was a case of "all dressed up and no place to go." Colonel Pope started to find an outlet through earnest and useful advocacy of cinder paths along country roads. That was the first of organized country road development."

Curing of Concrete Pavements With Calcium Chloride

By H. F. CLEMMER
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LOICAL design principles stand foremost among the accomplishments in the development and progress of highway construction during the past decade. In fact, the establishment of rational design principles has been, without doubt, the greatest single factor in the development of related highway systems. From an economic standpoint, exact calculations made possible by the present day technology of highway design permit better construction, longer life, lower cost, greater mileage, increased utility, and quicker availability—all factors which attract the favor and support of the public. Maximum durability and strength of concrete are obtained by definite rules of proportioning, pavement slabs are designed on sound principles for known load capacities, subgrade bearing and lateral resistance are definite design factors, proper placing and proportioning of steel reinforcement gives maximum resistance to crack formation and load stresses, curing methods of known action speed the opening and assure the strength of the finished job. This article discusses curing and the advancement made in this phase of concrete pavement construction.

In the consideration of curing it is logical first to study the meaning of the term "curing." "Good curing of concrete is the setting up of favorable conditions for chemical action during the early hardening period." This explanation was offered by the Curing Committee of the Highway Research Board, a committee composed of engineers directly interested in the problem of curing. It must be pointed out, however, that curing mediums do not all have the same effect on concrete, and that, regardless of the medium used, there is always a number of uncontrollable factors, such as climatic and subgrade conditions, which must be given special consideration.

In providing favorable curing conditions it is primarily necessary that the concrete be supplied with sufficient moisture to insure the complete hydration of the cement. The prevailing temperature must also be conducive to proper curing. It is well known that the water normally incorporated in a concrete mix is in excess of that needed for complete hydration of the cement; it would be impossible to place the concrete should only water sufficient for this hydration process be added. Researches have shown that this excess water does not remain a part of the concrete, but is lost to the air by evaporation (resulting from prevailing atmospheric conditions), or to the subgrade by absorption, should the subgrade be of an absorptive nature. The problem of providing a continuous supply of moisture for the hydration process is, therefore, important.

Wet curing mediums (wet earth, straw, etc.) provide sufficient moisture, if the methods are properly employed, but, with the needed supervision and the necessity for keeping the curing material wet, these methods are obviously too dependent upon personal factors. Should the earth or straw become dry, either material immediately acts as a blotter, absorbs moisture from the concrete instead of supplying it, and the benefits of the curing periods are destroyed. Considering all the above, it is certain that a method which supplies sufficient moisture and yet eliminates the personal equation is of par-

ticular value. The use of calcium chloride applied to the surface of the concrete supplies such a method.

A comparison of the moisture content during the curing period, the strengths, volume changes, surface conditions, and resistance to natural destructive agents of two concretes, one cured with a standard method (wet dirt, wet straw, etc.) and the other by calcium chloride affords a medium for evaluating the relative merits of this curing agent. These are discussed later in this paper. In addition to these factors it is necessary to consider economy, the cost of the material and its application, as well as the inconvenience and expense caused the traveling public due to the use of detours, during unnecessarily long periods of curing by the old methods.

Moisture Supply Assured.—The hygroscopic property of calcium chloride, alone, makes this material of particular value in assuring a continuous moisture supply. When calcium chloride is placed upon the surface of the concrete (after the wet burlap treatment) dissolution takes place in a short time and a solution results. It is interesting to study data as to vapor pressure as shown in Fig. 1. Assuming that the temperature is 80° F. and the relative humidity 60 per cent, it will be noted that the vapor pressure of the moisture in the air is 15.6 mm. Under these conditions a calcium chloride solution whose vapor pressure is other than 15.6 mm. cannot exist. If the solution has a lower vapor pressure than that of the moisture in the air it will absorb moisture until the vapor pressure of the solution and the vapor pressure of the moisture in the air are equal. Should the solution have a higher vapor pressure it would lose moisture to the air until equilibrium of the vapor pressures resulted. This latter condition is, however, very rarely encountered with calcium chloride surface curing inasmuch as the calcium chloride upon dissolution forms a saturated solution and is gradually diluted to a solution having a vapor pressure equal to that of the moisture in the air. The formation of this solution on the pavement prevents the evaporation of the mixing water.

It is important to consider the problem of moisture loss to the subgrade. If the subgrade is not of an absorptive type, the moisture loss is confined mainly to surface evaporation, which, as explained above, is prevented in the case of calcium chloride surface curing. However, if the subgrade is of an absorptive type there will be a rapid loss of the mixing water from the concrete to the subgrade. In this event, if moisture were not continually supplied to the concrete, the hydration process would cease. This condition could readily be encountered with any curing medium, the principle of which depends on sealing the mixing water in the concrete by preventing surface evaporation; however, the calcium chloride surface method offers an advantage over such curing mediums, in that it supplies surface moisture and thereby a constant supply of moisture for hydration of the cement regardless of the loss through subgrade absorption. As loss through the subgrade takes place, the surface moisture furnished by the calcium chloride enters the concrete and supplies the necessary moisture for hydration.

Strength.—Satisfactory strength is a prime requisite

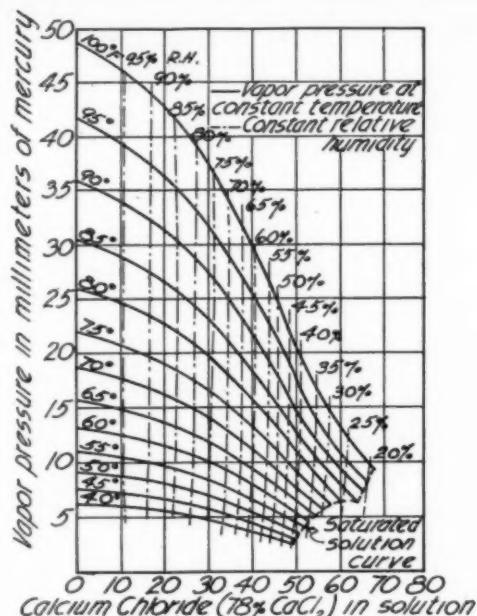


Fig. 1, Vapor pressures of Calcium Chloride solutions (from Dow Chemical Co.)

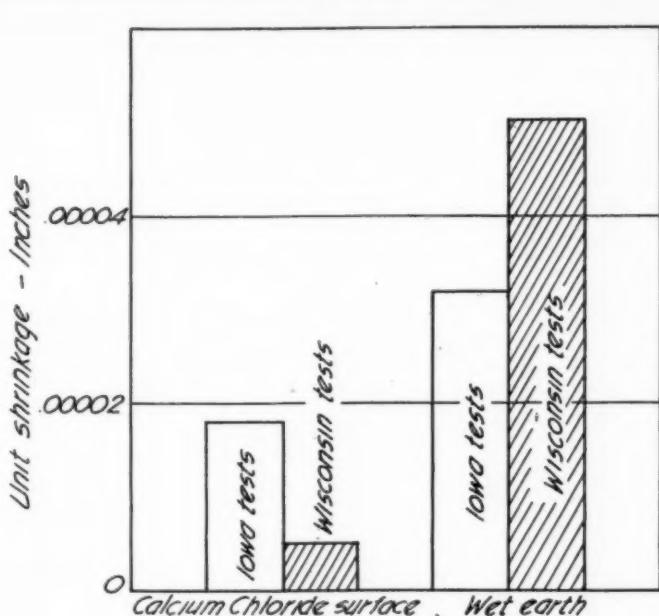


Fig. 2, Volume changes - data from Iowa and Wisconsin investigations - Highway Research Proceedings, December, 1930

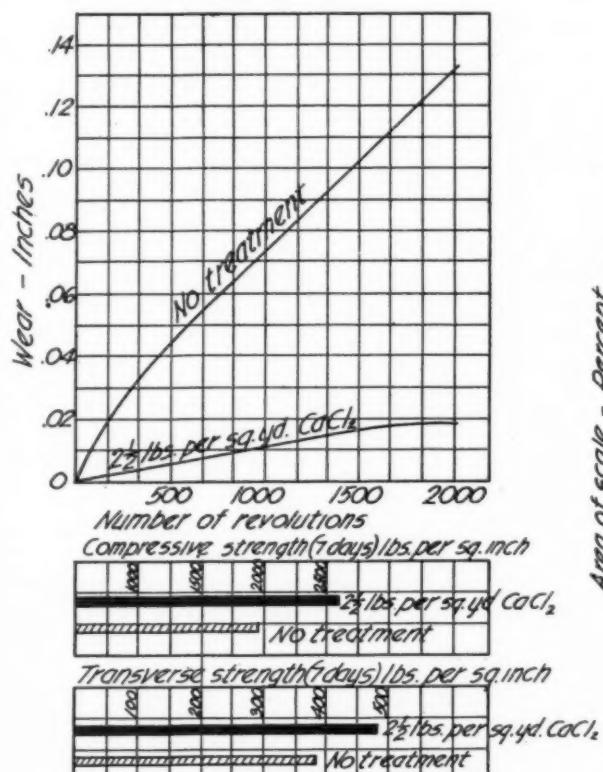


Fig. 4, Wear and strength results taken from Illinois investigation, 1921

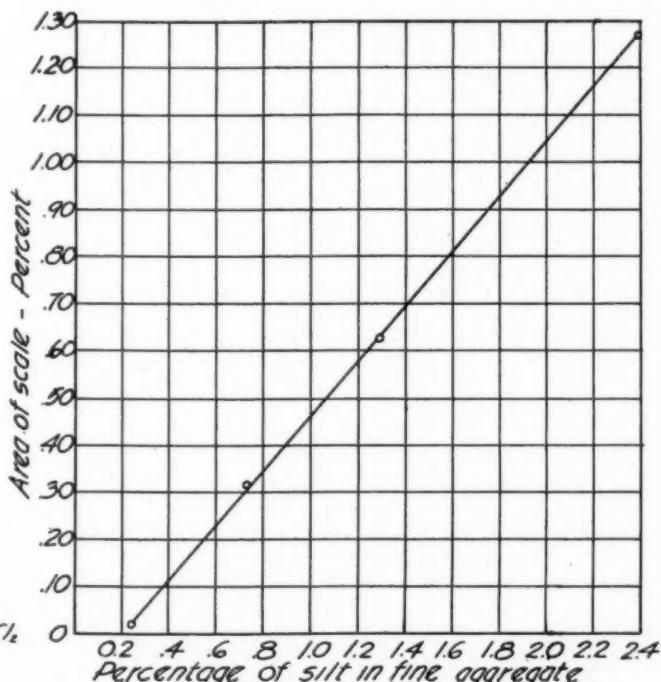


Fig. 3, Relation between silt content of fine aggregate and the area of scale - Highway Research Proceedings, 1930

Figs. 1-4.—Vapor Pressures; Volume Changes; Relation Between Silt Content of Fine Aggregate and Area of Scale; Wear and Strength Results.

of durable concrete. Regardless of the precautions taken in the manufacture of the concrete as to amount and quality of cement, aggregate, and water used, the quality of the resulting concrete is dependent upon the protection provided during the early hardening period. It is believed that many of the unexplainable failures of concrete, in which the ingredients have been of satisfactory

quality and properly proportioned and mixed, could be attributed directly to low strengths due to improper curing. Whether or not engineers place too much emphasis upon the strength factor is debatable, but it certainly is deserving of particular attention since we are well aware that strength bears a direct relation to the durability and density of the concrete.

It has long been recognized that the calcium chloride surface method of curing insures satisfactory strength. This fact was definitely established by an extensive investigation of curing mediums conducted by the Illinois Highway Department in 1921. The investigators concluded that the use of this material insured maximum strength of concrete, permitted early opening of the highways to traffic, and produced a durable and satisfactory riding surface.

Since the Illinois Investigation, studies have been carried on by many agencies including the Bureau of Public Roads and the Highway Research Board.

The following is a summary of a correlation of the results of over thirty investigations studied by the Curing Committee of the Highway Research Board.

Results are stated as the percentage of the strength of concrete cured with wet dirt or straw:

	Calcium Chloride Surface Curing	No. of (% of Standard) Specimens
FIELD TESTS:		
Compression (Cores taken from pavements)	96	267
Flexural	95	1,329
LABORATORY TESTS:		
Flexural	100	73

It is significant that none of the results of individual investigations vary much from the general average.

It is of particular interest to note an investigational project as to calcium chloride surface curing reported by the Bureau of Public Roads. This section was laid in the fall and no rain fell on it for 28 days and therefore, the results definitely indicate the value of this method of curing. The strength, as determined by core tests, was 96 per cent of the standard section which specified wetting for ten days—a requirement much greater than specified for ordinary construction.

It is most important to consider these comparative methods of curing. Curing concrete with calcium chloride is just as efficient under ordinary field control as under the most careful laboratory control, while it would be putting it high to state that dirt curing under ordinary field control would be 80 per cent as compared to ideal laboratory control.

It is evident that the relative strengths for calcium chloride curing are more than equal to wet dirt curing under construction conditions.

Volume Changes.—Pavement survey data indicate that volume changes will result in the cracking of pavements, should the resulting stresses set up be in excess of the tensile strength of the concrete slab. Variations in the climatic conditions, changes in the moisture content of the concrete slab, and the difference in subgrade characteristics are among the factors influencing volume changes.

In the case of a comparison of curing mediums, however, it is believed that only those volume changes due to moisture variation in the concrete slab should be considered, inasmuch as this factor can be controlled to a greater extent than either of the remaining two. For instance, on a research investigation as to curing, the prevailing atmospheric conditions and existing subgrade characteristics will be identical for several research sections, but due to the character of the curing medium the moisture content of the different sections may vary.

Inasmuch as calcium chloride surface method of curing would prevent the loss of moisture due to surface evaporation, and, too, since some or possibly all of the moisture loss due to subgrade conditions is replaced by the surface moisture, this method of curing has particular merit in preventing volume changes since, through its use, the moisture content of the slab remains nearly constant.

The results of a research project carried on by the Bureau of Public Roads definitely indicate that the curing medium affects transverse cracking and slab length. The investigators are of the opinion that the primary function of any curing medium is to retain moisture in or supply moisture to the concrete from the time the slab is placed until sufficient strength has been attained by the concrete to resist stresses due to contraction when the slab is finally allowed to dry. Should the curing medium fail to function properly, increased cracking is to be expected. The results of this investigation reported by the Bureau of Public Roads are highly significant inasmuch as the traffic carried by the test sections was not heavy and the concrete was constructed on a uniform subgrade.

In a summary of significant data for various types of curing, the slab length rating for a calcium chloride surface-cured section on which there was no rain for twenty-eight days after placing was stated as 100 per cent, that is, the average uncracked length of the pavement slab was the same for both the calcium chloride cured and the standard sections. The significance of these results is more striking on consideration of the standard which required the application of burlap kept wet for 24 hours, followed by a 2-in. layer of dirt kept wet for ten days; the earth cover to remain in place for at least 18 days—a specification far more rigid than is to be expected to be required in construction practice.

In a similar investigation conducted by the Illinois Highway Department the length of the uncracked slabs on the calcium chloride cured sections were found to be much greater than those sections cured by wet dirt.

The ability of calcium chloride to provide surface moisture is a factor in preventing the formation of "hair cracks," by protecting the concrete from too rapid drying.

Tests conducted by the Iowa and Wisconsin Highway Departments on volume changes are shown in Fig. 2 (Highway Research Proceedings, Dec., 1930, p. 398). These results show that the volume changes of concrete cured by the calcium chloride surface method are much less than for concrete cured with a covering of wet earth. Without question the shrinkage occurring during the setting of the cement controls to a large extent the quality and durability of the resulting concrete. Many ultimate failures undoubtedly originated as incipient cracks caused by volume changes during this hardening or early curing period and before the concrete had gained sufficient strength to resist such stresses.

Surface Condition.—Probably the most complete study and survey ever made on surface condition of pavements was that conducted by the Curing Committee of the Highway Research Board. During 1929 a survey was made of approximately 2,000 miles of concrete pavement, over 600 of which were dirt cured and 1,250 cured by the surface application of calcium chloride. This survey covered the States of Wisconsin, Minnesota, Illinois, Missouri, and Rhode Island.

Scale is the typical thin layer of surface that flakes off cleanly from underlying sound concrete. The following conclusions as to this survey were drawn by the committee:

(a) Calcium chloride surface application used as a curing method under normal conditions is not a primary cause of scaling.

(b) If conditions conducive to scaling are present the scale will probably occur to some extent under either earth and water or calcium chloride surface method of curing.

(c) Insofar as calcium chloride surface curing is concerned, scaling is not an important factor.

It is not believed that scaling can be attributed to any

one factor alone, but rather to a combination of several of the following: cement, aggregate, the curing method, excessive mixing water, harsh mixes, over-finishing, silt, and frost action. The results (Fig. 3) show the relation between the silt content of the fine aggregate and the area of scale as reported by the Minnesota Highway Department for four projects. This indicates the importance of the proper control of silt in aggregates.

The practice of brooming is one of the recent measures undertaken to eliminate the unsightliness of scaling. In

shall be applied to each square yard of the pavement surface. The material shall be spread by means of a squeegee or suitable mechanical device. . . . Calcium chloride shall not be applied during a rain, and if a rain occurs within two hours after placing, the calcium chloride shall be replaced."

It has been found practicable to apply the calcium chloride the first operation in the morning, following the day of placing the concrete. This permits the use of the burlap for covering of the pavement being laid; and

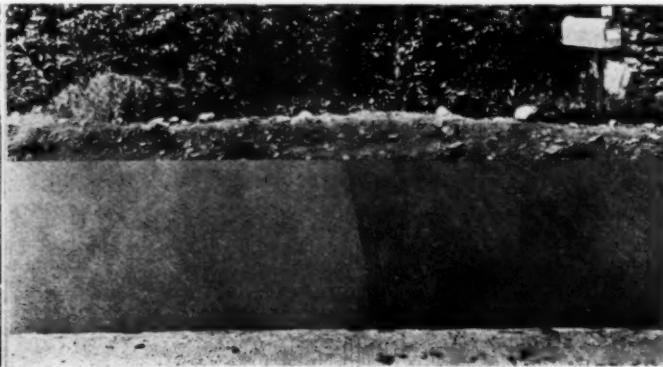
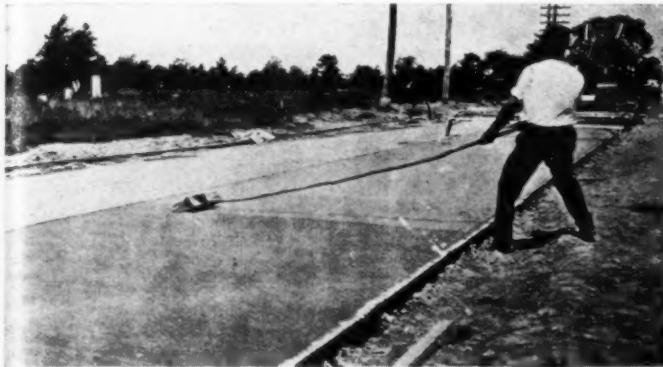


Fig. 5.—Brooming Operation and Appearance of Broomed Surface.

this practice a street broom, approximately one foot wide, is pulled gently over the surface of the concrete pavement, from edge to edge, after the concrete has been belted and straight-edged, but prior to the initial set. The brooming should be perpendicular to the center line of the pavement and the depth of the broom corrugations should not exceed $\frac{1}{8}$ in. Fig. 5 shows the appearance of the pavement after the brooming operation. This method of finishing provides increased traction and improves the appearance of the surface.

Wear Resistance.—A characteristic property of concrete heretofore considered relatively unimportant is now receiving attention in many of the research programs. Wear resistance is necessarily a measure of the ability of the concrete surface to resist erosion due to traffic. Factors affecting the coefficient of wear of concrete are the type of aggregate (both fine and coarse), mix proportions, quality of cement, and the curing medium.

Tests conducted by the Bureau of Public Roads show the calcium chloride surface method of curing to produce a wearing surface having even greater resistance to abrasion than concrete cured by the Standard method (previously described). The average wear for the calcium chloride surface cured sections was but 98 per cent of that for the standard cured sections; that is, the concrete cured by the surface application of calcium chloride showed less wear than that cured by covering with wetted dirt for ten days.

The results (Fig. 4) showing the wear on calcium chloride surface cured sections as compared to the wear on uncured sections, are taken from the report of the Illinois investigation of 1921; comparative compression and flexural strengths of the concretes are also shown.

Surface Application.—The following method for the use of calcium chloride is taken from the "Tentative Specification for Curing Portland Cement Slabs by Surface Application of Calcium Chloride," American Society for Testing Materials.

"After the final finishing operation the concrete shall be covered by a double thickness of burlap kept saturated with water. The burlap shall remain until the concrete

will bear the weight of a workman without damage but in no case less than twelve (12) hours. . . . After removal of the burlap, two pounds of calcium chloride the greater humidity of the atmosphere in the morning insures rapid dissolution of the calcium chloride.

Many factors must be taken into account as to the economy of this method of curing. The availability of covering material and a sufficiency of water for keeping the material saturated vary considerably in different localities, but in general the cost of calcium chloride and its application are approximately the same as for dirt curing and in some cases much less. The real economy in using calcium chloride for curing is in the elimination of continued inspection and in the assurance of uniform and maximum curing. It is the adoption of methods which do not rely on personal inspection that improve construction practice and insure the best results.

A careful study of the foregoing discussion and data proves that the use of calcium chloride applied on the surface of concrete for curing insures maximum strength of concrete, controls volume changes thereby producing a more durable concrete, and provides a hard wear resisting surface.

Traffic Striping Cost \$40 Per Mile

Practically 3,500 miles of traffic stripe were placed on the state highway system of California in 1932 at an expenditure of about \$163,000, according to California Highways and Public Works. This includes restriping some of the heavier traveled sections in the Los Angeles and San Francisco territories. On the average, it cost \$40 per mile for placing a 4-in. stripe during the last year.

Fifteen gallons of traffic lacquer were used per mile of stripe which represented about three-quarters of the expense. On all the striping work, whether handled by day labor forces or under contract, particular care is taken to secure a true, even line. The specifications require that a deviation of more than $\frac{1}{2}$ -in. from the true line in a distance of 20 ft. indicates the standard maintained.

Man Power and the Machine In Highway Work

By JOHN H. MULLEN

President Nelson, Mullen & Nelson, Contractors, Minneapolis, Minn.

THE question of man power and the machine is receiving a great deal of attention these days and its consideration has developed into somewhat of a major economic controversy. Some very extravagant statements are being made on the subject, particularly by a new cult, self-styled Technocrats, to the general effect that the development of machinery has reached a point where all of the work in this country can and will be done by the employment of only the workable adults between the ages of 21 and 45 for only 660 hours each per year, and that this amount of work will provide all of the people a much higher standard of living than the average person has previously enjoyed, with lots of leisure for everyone. This Utopian theory assumes possibility of our highly individualistic country submitting to a most radical form of Communism, which is very improbable, and apparently, from the experience of Russia, unworkable. However, this phase of their program does not interest us so much as their arguments on the displacement of man power by the machine. While the statistics used by Technocracy to show the falling off in man hours per unit of production in industry are no doubt correct, and it is probably true that an adjustment must take place in employment due to development of machinery in manufacturing, their assumptions of the monstrous growth of machine methods in other lines are not so plausible. Just take as an instance their reference to road building, which we are particularly interested in and see what they say; I quote from one of their articles by Mr. Parish:

"A machine is already developed and waiting for a public works market that, with two men operating it per shift, or six men for each 24 hours, can tear up an old road or street, lay foundations for pavement, and put in the pavement sixty feet wide at the rate of eight miles per day."

The absurdity of this statement is apparent to any one familiar with highway construction. Nevertheless, we have to admit that machinery has displaced hand labor to a considerable extent on highway construction and maintenance in the field, and will probably continue to do so, but in my opinion, to not so great an extent in the future as in the past few years.

Labor Production in Road Work.—We are indebted to the Highway Research Board of the National Research Council, to the United States Bureau of Public Roads, and to the Minnesota Highway Department for data on the employment of men on road work, from which we derive the following average figures for the whole country. These figures must be taken as approximate and naturally vary with conditions and localities but are relatively correct for the periods named.

Data is very meager for 15 years ago but an estimate of the direct employment of labor on road work per unit of production in 1917 would be $1\frac{1}{3}$ cu. yd. of grading and .9 sq. yd. of paving per man hour. Maintenance figures would be difficult to determine for this period.

The following five years saw but a slight change in the production by labor on grading, the figures given by the Highway Research Board showing 1.8 cu. yd. per man hour. Their figure for paving in 1922 is 1.03 sq. yd. per man hour and the other data mentioned gives 600 man hours per mile for maintenance.

Introduction of Machinery Steps Up Output.—Then comes the next six-year period which really marks the change in highway construction methods, and we find that in 1928, due largely to the introduction of machinery, production was stepped up to 2.7 cu. yds. of grading and 1.47 sq. yd. of paving per man hour, an increase of 48 per cent on grading and 42 per cent on paving. Maintenance during this period became more intensive and included considerable light construction, but had not become motorized, so that the records show an increase to 650 hours per mile per year.

The past four years show an increase of production in all work, last year reaching the figure of $3\frac{1}{3}$ cu. yd. of grading per man hour, an increase of 23 per cent, and 1.7 sq. yd. of paving, an increase of 16 per cent. Maintenance in the past four years has become highly motorized and the records show that the man hours employed per mile per year was decreased from 650 to 470, which means an increase in production of 40 per cent per man.

Summarizing these figures we find that in the last ten years, the production or accomplishment per man was increased 65 per cent on paving, 83 per cent on grading and 56 per cent on maintenance and that the reduction in man power per unit of work was 40 per cent on paving and 46 per cent on grading, averaging 43 per cent, which would also be approximately the percentage on maintenance.

Lower Unit Prices And Increase of Skilled Labor.—The increase in production per man hour employed on road work and the consequent decrease in employment per unit must be credited to the development of machinery. However, this does not tell the whole story, and must not be considered by itself, for with the development of machinery and the consequent decrease of labor employed per unit of work, came a lower unit price for the work, enabling more work to be done per dollar. Also, introduction of machinery changed the character of employment from a preponderance of common labor to a greater percentage of skilled labor operating machinery at higher wages; a very desirable condition, for if development in an industry does not benefit the workers in that industry as well as to gain material benefits for others, it is not progress. This change in the character of employment is exemplified by comparison of a grading outfit of ten years ago in which 85 per cent of the employees were common labor, and the outfit of today wherein 70 to 75 per cent of the employees are skilled or supervisory employees. Then, too, one must take into account the men employed on work incidental to the actual field operations.

Increased Employment in Machinery Manufacturing.—Prior to 15 years ago the employment of men in industries related to road work, was very light, as compared with those employed in the field, but in the past ten years, which might be called the machine age, these industries have employed many thousands of men manufacturing, repairing and marketing road machinery, so that while the figures show a substantial falling off in the number of men per unit employed directly on the work, the machinery which caused this decrease made necessary the employment of a large percentage of that number in manufacturing and distribution activities. Authentic data are not available to determine just what this percentage would be, but an exhaustive study of cost distribution on pavements was made under direction of the United States Bureau of Public Roads by Mr. J. L. Harrison, which shows that on road work the average equipment expense, namely, repairs and depreciation, is over 46 per cent of the amount expended for labor. Properly assuming then, that this expense is made up for the most part by payroll items—for the cost of equipment is not in the raw materials used but is in the manufacturing and distribution of them—we come to the conclusion that while there has been a decrease of about 43 per cent in the number of men employed in the field per unit of work in the past ten years, more than one-half of this apparent saving of man hours per unit is really a transfer of employment from the field to the industrial centers. The correctness of their figures is borne out by the writer's own experience on road construction contracts where the repair expense on a year's operation of a completely motorized grading outfit is actually 40 per cent of the amount paid for labor. This does not take into account depreciation, which on the basis of an average of five years' use of equipment, amounts to 35 per cent of the amount paid for labor. Assuming that only 75 per cent of this equipment expense, repairs and depreciation, goes into wages and salaries, which is a low estimate, then we find that 56 per cent as much is expended per unit of work for employment in the repair and replacement of road machinery as is actually spent for salaries and wages on motorized outfits in the field.

Mechanical Methods Decrease Cost of Work.—This analysis brings out some interesting deductions, worthy of consideration by highway officials who are being urged under present conditions to revert to hand labor methods. In the first place, we find that since the adoption of mechanical methods, particularly in the last ten years, the cost of work throughout the country has been decreased over 35 per cent, according to an abstract by the Highway Research Board, but let us take as an actual instance the State of Minnesota, which has done a great deal of grading in that period and where the methods have changed in the same period from team and hand labor to almost entirely motorized methods with heavy equipment. Their records show that the price of earth excavation and haul decreased from 31 ct. in 1922 to 19.6 ct. in 1931, a decrease of 37 per cent and the price of all classes of excavation, combined, from 39 ct. to 22 ct., a decrease of 44 per cent, and this in the face of an increase in pay for common labor from 30 ct. to 45 ct. an hour. This decrease in the price of work should not be so great, and is not warranted, for it represents, in part, ignorance by the contractors of their depreciation expense. This is accounted for by the fact that the use of heavy equipment is so recent that contractors have not realized the cost of replacement and in the next year or two, will result in the elimination of many contractors and a partial return of prices. How-

ever, even taking into account proper allowance for equipment expense, the cost of work has greatly decreased.

Secondly, we find that while the number of men per unit of work has decreased, the character of employment has been raised for the majority of employees from common labor to mechanical work with higher pay, and the decreased unit price for work has enabled enough more work to be done per dollar, even at a higher wage rate, to take care of a considerable portion of the decrease in field employment per unit.

Third, and what is important to a state having manufacturing industries, the use of machinery on road work gives employment to about half as many people in the machinery business as are employed on the job. So that on the whole the displacement of man power by the machine on road work has been a benefit to labor, as well as providing the speed and efficiency which this age demands.

Acknowledgment.—The foregoing is a paper presented at the 1933 Wisconsin Road School.

Patching Old Concrete Road

In the reconstruction of the Richmond-Washington highway on the section between Washington and Fredericksburg, Va., the system of making patches in the old road that was widened to 30 ft. by the addition of a 11-ft. concrete strip was as follows:

A section 10 ft. wide was cut out and forms set on both sides as shown in the illustration. This width was selected so that traffic would not be interrupted when



Patching With Central Plant Mixed Concrete

the remainder of the old concrete was cut out to widen the patch. Concrete mixed at a central plant so that the haul was about 20 minutes was delivered in agitator body trucks and hauled out to the section of road to be patched.

Traffic on this road is heavy as indicated in the line of cars shown in the illustration that is waiting in the short space of time required to dump the truck.

HIGHWAYS IN UNION OF SOUTH AFRICA.—The area of the Union of South Africa is 471,917 square miles, and the population, 7,947,000 (1929). In 1932 motor vehicle registration totaled 156,850, divided as follows: Passenger cars, 139,400; busses, 1,450; and trucks, 16,000. No highway figures have been compiled since 1931, when the mileage was estimated to be: 750 miles of hard surfaced roads (mostly macadam); 27,500 miles of graveled and drained; and 82,968 miles of unimproved earth or veldt, passably only in the dry season.

EDITORIALS

Automatic Versus Planned Control of Industry

IN a recently published address, Benjamin M. Anderson challenges the theory of control of industry by governmental planning. Dr. Anderson is the economist of the Chase National Bank of New York City.

He says:

"Here then is the central contrast between our present system and a planned economy—in the problem of co-ordinating the economic activities of men and making a social order. Our present system relies upon the unconscious, automatic functioning of the markets. A "controlled economy" must do it, if at all, by conscious public planning, a central brain guiding, controlling and regimenting the masses of men, controlling production, controlling consumption, controlling the distribution of wealth and, in a large measure, regulating the lives and activities of men.

"If we wish revival without an early relapse into chaos, I do not think we shall go far with the advocates of the planned economy. They cannot make a comprehensive plan. The ablest and best trained brains, given unlimited power, could not do it. The ablest students of economic theory can, for a little while, at times when their energies run high, see in theoretic outline, in schematic outline, an abstract picture of the economic order. The concatenation of prices and costs, the interrelations among the industries, the international interrelations, the relations of capital market, money market, securities market and industry—there is a body of economic theory dealing with these matters sufficiently definite and sufficiently clear to enable us to reach some very important practical conclusions regarding public policy. But to put flesh and blood upon this abstract skeleton, so as to make it a thing adequate for conscious control of industrial life, is an impossibility. We have an immense mass of statistical detail regarding many phases of economic life, but not nearly enough for purposes of this sort, and not, moreover, in manageable form. Further, it cannot be assembled with sufficient speed to enable one central planning body or one central brain to use it in making day by day decisions. Neither economic theory nor statistics begins to supply the necessary foundation for dealing with such a problem. The best industrial and financial intelligence sees only a part of the picture with definite realism. The coordination of the multitudinous elements must be through the markets, and not through a central brain or central authority.

"But, further, no one supposes that if we are to have a planned economic order the matter would be turned over to the men who have trained themselves to see the whole economic picture. They would not be regarded as competent to handle the administrative problem—and they would not be. The thing would be turned over to practical administrators, chosen primarily with respect to their ability to get along with men, and with respect to their acceptability to controlling political groups, and instead of *economic planning* we should get *political compromise*. The plans that would be made would be only partially harmonious from the standpoint of economic consistency. They would be, in large part, a mere resultant of political pressures, contradictory in their economic implications.

"The administrative problem would be an impossible problem, particularly difficult in the United States be-

cause of our conflicts of State and Federal jurisdictions and our Constitutional limitations. With the control of industry, it would involve an immense bureaucracy—a bureaucracy so great that it might, indeed, go far in solving the problem of unemployment!"

The foregoing quotation is only about 6 per cent of Dr. Anderson's 24-page paper, the title of which is "A Planned Economy and a Planned Price Level," copies of which can probably be secured by writing to The Chase National Bank, New York City.

It is admitted by President Roosevelt that many features of the National Industrial Recovery Act are experimental. Dr. Anderson argues that economic experiments should be conducted on a small scale before applying the "cure" on a large scale. He says:

"This sick economic world of ours is a patient in a hospital, not a subject for experimentation in a laboratory. And if, as I believe is the case, we can cure this patient by tried and tested measures, surely we have no right to discard those tried and tested measures and to turn the patient over to a new school of physicians who have some theories that have never been known to work.

"In medicine, when radical new measures are proposed, it is at least the common practice to try them out on animals first, and then, after long and careful experimentation, to try them out tentatively on human beings. We must certainly ask the new schools of economic practitioners to try things out on a small scale first, tentatively and cautiously, before they ask us to transform the whole economic system radically.

"We have heard a great deal about the failure of the so-called old economics, and the need for new doctrines. I think it can safely be said that there has been no failure of the old economics in this post-war period, because so little of what the old economics advocates has been done. The old economics taught, and teaches, that tariffs should not be unduly high, and that goods should move with reasonable freedom across national borders. The post-war period has seen a steadily mounting body of tariffs and other trade barriers, choking the flow of goods across national borders.

"The old economics taught that excessive credit and artificially cheap money would generate great speculation and the piling up of unsound debts which could not be paid and which, in their qualitative deterioration and collapse, would create crisis and panic. But we spent the post-war years, especially from 1922 into 1928, in an altogether unprecedented expansion of credit at artificially low interest rates, with rediscount rates held below the market instead of above the market as the old rules prescribed, and we generated a credit bubble and a speculative bubble, the collapse of which has brought us untold disaster."

In the last sentence Dr. Anderson states the main cause of the economic disease from which America has been suffering for 3.5 years, namely, an undue expansion of credit. We agree with him as to the cause, but not as to the length of time that it has been acting. It antedates the 15 years that have elapsed since the war ended; for long prior thereto American per capita indebtedness had been growing much faster than American per capita income. We had become debt addicts, and were giving ourselves increasingly large "shots" every year, except when a business depression temporarily halted the operation. But as soon as a depression passed away, we renewed the old habit with increas-

ing gusto, until at last American indebtedness in 1929 had become about 75 per cent of the total wealth. This load of debt was bound to become disastrous. It was not the result merely of the post-war boom, although that added substantially to the debt burden. It was a burden that had grown almost imperceptibly greater for two generations, until it had reached the almost unbelievable total of \$300,000,000,000, or \$2,000 per man, woman and child! Could owners of farms, mines, factories, railways, etc., etc., weather a financial storm when thus loaded with debts? Up to 1929 we hoped they could. Now we are disillusioned. Yet most of our leaders are saying little about debt as the basic cause of the grand collapse. Nor are many of them pointing out that the same sort of a collapse will occur again unless we get rid of the cause. Indeed, many of the proposed cures of the business cycle disease are nothing else than more credit "shots in the arm."

Federal Rules Controlling the \$400,000,000 Road Construction

ON another page we give in full the rules and regulations governing road construction under the National Industrial Recovery Act. Among the most important of these rules is the one "providing a large number of small projects designed to employ the maximum of human labor." Although direct labor may be employed, it is evident that most of the work is to be done by contract under the direction of state highway engineers. The rules provide that the contractor shall furnish all materials used in the work.

Sec. 13 of the rules provides that: "In order to give effect to the provisions of this Act it will be required that the maximum of human labor be used in lieu of machinery wherever practicable and consistent with sound economy and public advantage." Since it is seldom "consistent with sound economy" to do any important kind of road construction without using machinery, this rule will probably be construed as applying only to the less important kinds of work and to small "dabs" of important kinds of work where the cost of transporting machinery would wipe out the saving effected by its use.

State and federal engineers are so well informed as to actual unit-costs of road construction that they will seldom differ with a contractor as to the dividing line that separates the region of high cost hand work from low cost machine work. And where the specifications do not clearly indicate that dividing line, doubtless the contractor will be permitted to exercise his own judgment. The object of the act is to provide employment, and that object is secured as well when machinery is used as when it is not used. A contractor will bid a lower unit-price for grading by machinery than by hand, and the public will receive a greater yardage for a given expenditure. In either case, workers will receive nearly all of the money expended. In this connection it should be remembered that the same holds true as to materials, for workers in quarries, factories, mills and railways are the recipients of nearly all the money paid for materials. After deducting operating expenses, including taxes, capital in the manufacturing industries receives about 10 per cent of the selling price of products in normal times, and much less in bad times.

Under this Act not more than 50 per cent of the federal funds apportioned to any state is to be applied on federal-aid roads outside of municipalities; not less than 25 per cent is to be applied to extensions of federal-aid

roads into and through municipalities, and not more than 25 per cent is to be applied to secondary or feeder roads except under certain specified conditions.

There is one very significant rule: "The Secretary and the Board reserve the right to require the construction of roads desired by the U. S. Railroad Coordinator to provide adequate year-round highway service in replacement of branch-line railroad service proposed to be abandoned."

It has been said that if one-third of the railway mileage in America were abandoned, the railways, taken as a whole, would be better off. How correct this estimate is we do not know. If correct nearly 90,000 miles of railway should be scrapped. Perhaps transportation over some such mileage will eventually be replaced entirely by motor-trucks and buses. Hence the paragraph just quoted may prove to be more significant than one would infer from its brevity.

An Unprecedented Opportunity to Improve Streets Aided by Uncle Sam

Under the \$3,300,000,000 federal appropriation for public works, any state, county or city can borrow 70 per cent of the cost of an improvement, and pay only 4 per cent interest, provided that the loan is amortized in less than 30 years. In addition, if it can be shown that the improvement is a "fundamental necessity," the federal government will make a grant or gift of the remaining 30 per cent of the cost of all labor and materials. Thus it becomes possible to finance almost the entire cost at about 2.8 per cent interest per annum, plus the amortization rate. Never before could public works be financed at such a low rate.

What projects will be classed as "fundamental necessities," and therefore eligible to receive a federal gift equal to 30 per cent of their cost, has not been fully decided. Secretary Ickes has announced that water works and sewers have been thus classed by the board, and that he personally would include school buildings. He said that stadiums and auditoriums might not be regarded as "fundamental necessities."

There is little doubt, we believe, that street improvements would be regarded by the board as being "fundamental necessities." A part of the \$400,000,000 appropriated for roads is to be spent on the federal roads through cities, but since the amount thus spent for city street improvement is very small compared with the real needs, efforts should be made at once to make needed street improvements with federal money, 70 per cent being borrowed and 30 per cent being Uncle Sam's gift.

Incidentally this is an excellent time to begin scrapping the prehistoric practice of assessing street improvement against abutting property owners. Begin by borrowing federal money for main thoroughfares that need repaving. The mileage in need of improvement is enormous if the streets over which the editor has recently ridden are fair specimens. Since nearly every one in a city uses such streets they should be paved at the expense of all taxpayers.

H. P. Gillette

County and Township Roads

A Section Devoted to the Interests of Those Responsible for Secondary Road Improvement

SECONDARY ROAD *Construction Policies in Iowa Counties*

By C. E. SMITH

County Engineer, Henry County, Iowa

HUMAN welfare is becoming more insistent in its demands that unified and intelligent course of procedure be laid out with a cost price marked thereon as opposed to the grab bag method of taxation as an institution of political expediency.

To propose and work toward a definite program of road improvement is most certainly the ideal method of procedure. This method and program should always be parallel with the taxpayer's ability to pay. I have given the matter all the consideration of which I am capable and have not yet been able to figure out an instance wherein a bond issue is justifiable.

You will pardon this bit of philosophy in that connection, but the actuating motive of all construction if largely that of the joy and pride in the doing, and most certainly, is not in the contemplation of paying a bill for a piece of work which someone else has enjoyed the cherished distinction of doing.

Every generation has always had and must continue to have something to do and if a way and condition can be provided whereby they can meet the cost as it comes, then we will have made progress in behalf of the construction industry. We will have eliminated the financial bondage of our people and emerged into the light of a new day. Our recent financial, economic and labor conditions lend most emphatic pronouncement to that theory.

Politics Should Be Left Out of Road Business.—The Bergman law was a start in the right direction, but it was only a start. We are fortunate, yet unfortunate, because of an infallible trait of humanity. Every man, regardless of whom he is, regards himself as an architect or an engineer, and from an embryonic standpoint that is correct, but it usually takes long periods of education and experience to make him capable of assuming the responsibilities of the broader aspects and intricate problems involved in civil affairs. Yet when it comes to the qualifications of the administration of our highways bodies there is but one, and that is political. There is no field of activity where politics could be better left out than the road business, yet there is no public enterprise where it seems more insistent to get in. The stupefied reticence of those who really know and appreciate these conditions should not hesitate to forewarn a politician laden public of this hoax of bombastacy to which they annually pay tribute.

We must not neglect to mention those isolated instances of altruism which have sought to breast the tide of misconception and wade out into the depths of leading the popular mind instead of being driven by it. But we

of southern Iowa have too often had foisted upon us, administrations that prefer to ride in a political band wagon at the tail end of the procession, drawn by the steeds of a misguided public opinion and driven by the lash of political expediency. One of the most effective whips of this remorseless driver is the day labor system of highway construction.

Day Labor Work.—During the recent session of the legislature a proposal was made whereby a county might do an unlimited amount of day labor without giving the artisans of a well-established industry a chance to bid on it. From an unbiased standpoint does that seem fair? Few men would pursue that course even though the work was their own personal property.

The idea that a man can hire help and do his own work with intelligent supervision, cheaper than he can contract it, is, most generally, fundamentally sound. If the job does not require a lot of expensive equipment which he does not have access to, if the job is not beyond his personal ability to supervise, he will succeed. He is at least actuated by that one predominant trait of human nature to protect his own personal interests.

From an idealistic standpoint, those same ideas are applicable to public works. Actually, are they? If idealism prevailed there would be no restrictive laws, rules or regulations, no jails, courts, executive or judicial officials, and peace and tranquility would reign supreme.

However, we are all more or less subject to human frailty and all of those cumbersome appurtenances of the state are not so much the sign of progress as the penalty of our folly.

Road Fund a Philanthropic or Business Institution.—Now the question comes as to whether we are to regard the road fund as a philanthropic or a business institution. We have a relief fund and must have as long as human frailty exists, and 90 per cent of the time, the ones who partake of that are physically unable to perform any work.

It so happens at this particular time that there are quite a number who are able and willing to return a service; but the basis of the whole situation is that there are too many men dependent on jobs and not enough in business for themselves.

The very nature of the work makes it impossible to give very many steady employment on highway construction. Men are not satisfied with intermittent employment, and if employed all the time, it is at a loss. The state tries to do that on their maintenance, and that, as all know, is the object of universal criticism.

Some are apt to favor the removal of this ban, or

"advertisement for bids," but is it to augment their political machine, or a great political reform in the interest of economy for the benefit of the taxpayers? Are officials elected for their ability to handle large forces of men economically, or are they elected for their ability to get votes?

Force Account and Contract Work.—How long would an engineer or a supervisor last if he fired men off a construction job as does a contractor? What protection would the taxpayer have under this system if we paid 10 per cent or 15 per cent more for a day labor job than would have been required under the contract system?

There is a prevailing idea that day labor system of public work is parallel with a man doing his own work, and it is that much saved, but I do not see it that way. All public work is a co-operative enterprise and must be paid from the common till, and we, and all other counties have almost invariably found that where a large amount of hand labor was involved a contractor can get that job done and make a profit at a smaller figure than wasteful methods of force account. In other words, force account publicly employed is not impelled by the welfare of the taxpayers any more than a contractor, but is rather, in general, actuated by the selfish motive in its own behalf and the usual one hour a day wasted offsets a fair profit to the contractor.

Granted that most supervisors assume office in an altruistic frame of mind; they are fresh off the griddle of election, done to a turn on one side by a large majority of small taxpayers or loud howling voters who pay no taxes at all; and who are particularly interested in doing all work by day labor and insisting on their share of the pilfer as a reward for their support. On the opposite side he is scorched by the mandates of right and justice toward the taxpayer who furnished the money for which he is to produce 100 cents worth of work for each dollar expended.

It most certainly appears to me, from a broader economic standpoint, that it would be much fairer to labor and industry, and surely for the taxpayer, to set up our projects to be executed at so much per unit and thereby encourage industrious initiative and pride in well wrought craftsmanship, than to evolve a means by day labor whereby the less fortunate may be encouraged to become a more constantly addicted burden to the taxpaying public; with the output of his labor an indefinite and unfixed quantity.

I have worked with force account construction for a number of years with an attitude that was favorable to its success, but have formed a uniformly accelerated opinion against it.

A preconceived plan, fair and open competition in lettings, a higher type of contractors, well developed specifications, more unified and less individualistic action on the part of administration would seem to combine to give the taxpayer the best break for his money.

The cry to do the work ourselves is a *prima facie* fallacy. More than 90 per cent of the taxes are paid by people who do not want road work. They are only interested in getting a square deal. The only way to do the work ourselves would be for each taxpayer to work the road himself in lieu of paying in money, which cannot be done. The alternative is for each taxpayer to pay in cash in proportion to his income and as soon as his dollar crosses the treasurer's counter he is through doing the work himself. His money may be used either to buy a job through open competition and the concurring encouragement of individual enterprise or to hire the henchmen of some politician at a very uncertain

amount with the associated stamp of public approval placed upon social dependence.

Definite County Road System Preferred.—I believe that a highway system can be worked out and adopted in much the same way as proposed in the Bergman law, but I am certain that a unified system of construction, with a definite and complete system mapped out for the entire county of all roads that are intended to be constructed and not subject to change, unless the best interest of the public would be served, is to be preferred over the piecemeal objective under the law as it now stands. Instead of selecting a 1-2-3 year program and patterning after the Russians, select 50 per cent of the roads and these 50 per cent will be found to carry more than 95 per cent of the travel. Do not have a mandatory levy but make it mandatory that not less than 50 per cent of all monies received for highway work be expended on construction work to be placed where the county administration deems it most necessary and the remainder used for maintenance.

The condition chart of the secondary road system put out by the Highway Commission stands as an indictment of our delinquency in road construction as compared to the northern part of the state. True, the contour of our part of the state, and lack of material, is in their favor, but that is all the more reason that we should that much more carefully plan and diligently execute a program than they. The northern part of the state can, and has, because of their level country built thousands of miles of road without a plan, but a plan and program, with careful attention to relocation, in our part of the state is a field of most profitable study and if we fail to take it up we are guilty of a betrayal of trust.

I do not believe in inaugurating projects for the purpose altogether of furnishing employment, or in bond issues with their attendant bulges in the labor market, because there must inevitably be a let down and labor is in worse condition than ever, but that labor be encouraged and helped to obtain homes and businesses of their own to the point where a legitimate industry can absorb the surplus without a burden on the taxpaying public.

I believe that the removal of property taxes and the institution of a transaction tax will help to attain this end. We must evolve a means whereby people will want to own a home and settle down instead of leading the nomadic life of our laboring classes.

We must unite behind an economic plan of administration of the taxpayers' money toward the definite completion of a unified system, in a manner that is not spasmodic, and that will be adequate for his needs; and cease frittering away his money for the purposes of political patronage and expediency, or else he will forthwith demand of the legislature that either his tax burdens cease or that the administration of the secondary road construction, as in the case of the primary, be placed in a different form.

Acknowledgment.—The foregoing is an abstract of an address presented before the Officials of the Fifth Iowa Highway District.

SEVENTH INTERNATIONAL ROAD CONGRESS.—The Seventh International Road Congress, under the auspices of the Permanent International Association of Road Congresses, will meet in Munich, Germany, from Sept. 3 to 8, 1934. The Road Building Exposition will begin on Sept. 4, 1934, and is expected to last 14 days. Following the Congress trips of inspection will be undertaken over various routes. These will converge at Berlin on Sept. 16 or 17, 1934, where a closing ceremony will take place.

Construction of Oil-Mixed Surfaces in Higher Altitudes

WHILE oil mixed surfaces have come into extensive use in the past few years, they have not been used to any considerable extent on roads in higher elevations. For this reason a paper presented at the 1933 Highway Conference at the University of Colorado by C. F. Capes, Highway Engineer, U. S. Bureau of Public Roads, is of much interest. Mr. Capes gives experiences and observations based primarily upon results obtained on 40 miles of surfacing constructed by the Bureau in Yellowstone Park during the season of 1931. The matter following is taken from Mr. Capes' paper.

This work involved two separate contracts and projects. One of these was a 24 mile project located in the central part of the Park. It was a plant-mixed job with a top course 3 in. in thickness before compaction on a base course of 5-in. uncompacted thickness placed just ahead of the top course. The other project consisted of 16 miles over Sylvan Pass at the eastern entrance. It was constructed by the road-mix method and had the same thickness as the other with the exception that the base course had been placed during the previous season. A 75 per cent asphalt road oil was used on the plant-mix job, while a kerosene cut-back asphalt was used on the road-mix job. These two different types of construction should eventually provide a fair basis for determining the adaptability of this kind of surfacing for roads at this elevation.

Climatic Conditions.—The average elevation of Yellowstone Park is about 8,000 ft. above sea level and the plant-mix project lies at approximately this elevation throughout its entire length. The project at east entrance extends from an elevation of 7,000 ft. at the East Gate to 8,600 ft. over Sylvan Pass, and most of the 16 miles lies between 8,000 ft. and 8,500 ft. above sea level. On account of this higher elevation and the heavy annual precipitation which occurs in this locality, cut-back asphalt was used. The coarser gradation of available road metal, which was a crushed basalt rock obtained from roadside quarries and pits also made the use of a cut-back desirable. On the plant-mix job, a pit-run aggregate of ideal gradation for use with road oil was obtainable from roadside pits.

It might be well to state that although the elevations mentioned may not seem extremely high, climatic conditions in the Yellowstone Park region are probably more severe than in many other localities of much higher elevation. In addition the region contains large areas of swampy, seepy ground which emit large volumes of water the year around. The average annual precipitation in the Park, as compiled from data secured by the U. S. Weather Bureau over a period of 20 years, is 18.1 in. This includes an average annual snowfall of 98 in. The average snowfall and frost period is from September 20 to June 1 each year, and snow and frost every month in the year are no more infrequent than they are on the higher Colorado passes. The temperature ranges from 95° above to 40° below zero, with a mean maximum of 50° and mean minimum of 27°.

Construction and Maintenance.—With these conditions in mind every effort was made to drain and stabilize the subgrades preparatory to receiving the oiled surfaces, and the results thus far obtained indicate a high degree

of success in this respect. Although some failures have occurred, if softening and corrugation of the oil mat can be called a failure, none of these can be definitely identified as directly attributable to subgrade failures. Construction was finished late in the fall, and the seal coating was completed about Oct. 10. The following spring traffic began using the roads before the snow was entirely gone because there was no snow removal equipment available to clear the roads adequately. This allowed considerable surface moisture from melting snow to enter the oil mat and seep through between the base and mat, particularly on the section at the east entrance. This caused some badly corrugated surface on about four of the 16 miles. This condition was readily rectified by scarifying and reprocessing. Prior to this time there had been some doubt as to the possibility of scarifying and reworking surfaces in which cut-back asphalt had been used. It was found that such a surface can be ripped up with ordinary late-model power patrols and reworked without the use of a harrow, although it is believed that by using a harrow the drying-out process can be expedited considerably and the relaying of the material thereby facilitated.

Shoulders.—Each of these projects had a 20-ft. oiled surface on a roadway 24 ft. wide from shoulder to shoulder. This left a 2-ft. unsurfaced shoulder on each side which absorbed moisture and allowed water to enter and flow under the mat. The resulting damage was noticeably greater on superelevated curves where the water from melting snow on the high shoulder would flow directly across the roadway, both on the surface and under the oiled mat. This indicated the necessity of clearing the entire shoulder to shoulder width of snow when maintaining the road for traffic during the spring thawing period. Another method of avoiding this condition which is now being practiced on surfacing projects in the Park as well as elsewhere, is to surface and oil-treat the entire shoulder to shoulder width. Even with this improved method of construction it will still be necessary to remove all snow from the roadway and keep the road ditches opened in order to obtain the best results during the critical period of early spring maintenance. To overcome this condition on the projects already built, it is planned to try seal-coating the shoulders on superelevated curves.

The unimproved roads in Yellowstone Park have always given considerable trouble on account of frost-boil action in the spring, or when the roads are first opened to traffic, which is usually during the first half of June. It is generally necessary to do a large amount of heavy hauling incidental to preparations for the tourist season which begins June 20. This heavy hauling is over subgrades saturated with water and in many cases is over surfaces still covered with snow. With the possible exception that most highways do not receive a sudden heavy volume of traffic following immediately or even starting during the spring thaw, this is typical of many roads in high altitudes. There has been no indication of frost-boil action on the 40 miles of oil-surfaced roads thus far reconstructed by the Bureau. This is probably due to extensive subdrainage installation and to the practice of maintaining a grade line from 18 in. to 2 ft. above the surrounding water table. The material used in constructing this roadbed was fairly porous. It was some-

times obtained from adjacent excavation, but more frequently from selected material from borrow pits. Due to the scarcity of good durable road metal and even of suitable selected material in some sections, Yellowstone Park presents a particularly difficult problem which is not generally encountered in mountainous regions where an abundance of siliceous material is ordinarily available.

Road Surfacing Material.—The most durable and satisfactory road surfacing metal which thus far has been available, and this is found in only a few scattered localities in Yellowstone, is derived from crushing basalt rock. A few gravel deposits exist but usually these do not provide material of the desired hardness. The most generally available material which is suitable for selected material filling or temporary surfacing and which if mixed with a proper bituminous binder might prove satisfactory for hard surfacing, is a volcanic sand commonly called obsidian sand. This material as it comes from the pit is practically all between $\frac{3}{4}$ in. and 100-mesh in size with little or no 200-mesh fines. The larger pieces are fairly hard and the bulk of the smaller particles are flinty, hard and glass-like, from whence comes the name obsidian, meaning black glass. This type of aggregate was used with a cut-back asphalt on one or two short trial sections of the plant-mix job and the results thus far have been quite satisfactory. The lack of 200-mesh material in the aggregate was offset by the use of a greater percentage of bituminous binder. The surface may require frequent seal-coating, although none has been necessary to date. The road surface is quite black in color, is very stable and hard and closely resembles sheet asphalt pavement without the sheen or glossy surface.

Maintenance Is Necessary.—It must be borne in mind that this type of pavement is an inexpensive, delicate, sensitive surfacing and that it must receive the utmost consideration as such in constructing adequately drained subgrades, laying the surfacing, and in maintaining it under traffic in order to afford the most economical and satisfactory results when it is used in the higher altitudes. The fact that a well-constructed oil surface gives such highly satisfactory riding qualities probably cultivates the misapprehension of its permanence but in reality probably its most valuable feature lies in the fact that it may be reprocessed and refined readily and economically without serious inconvenience to traffic and with slight deterioration or loss of quality of the surfacing.

The actual laying of oiled surfaces in the higher altitudes is materially handicapped by weather and climatic conditions. At Yellowstone Park the season of 1931 was exceptionally favorable for this kind of work; nevertheless it was not possible to mix or lay the cut-back surfacing satisfactorily except in the heat of the day. Because of the atmospheric conditions it seemed necessary to do an exceptional amount of processing and turning of the materials because the volatiles in the bituminous binder pass off more slowly in the lower temperature of the higher altitudes. These difficulties as well as interference by rain and showers which are always more frequent in the higher elevations, are obviated to a large extent by the use of the plant-mix method. However, when the pre-mix method and cut-back asphalt were used, it was necessary to spread and finish the material promptly after it was delivered on the road because heating and premixing eliminated most of the volatile constituents in the asphalt. Where the 75 road oil which constituted the binder for most of the pre-mix material was used, it was possible to work the surface for 24 to 48 hours after it was spread on the road and sometimes a light dragging or wire brooming was possible on the third day.

Conclusion.—There seems little that can be said regarding the construction of oiled roads in the higher altitudes other than that which is applicable or essential to this type of construction elsewhere. The subgrade must be adequately drained and stabilized. This is a fundamental requisite for this type of construction anywhere. An adequate amount of bituminous binder should be used, and here it might be stated that on the Yellowstone jobs for 5 to 6 per cent of bituminous binder was used. This amount approaches the upper limits specified and may appear excessive, but no indications of bleeding or excess oil have been apparent. Excess moisture sometimes caused a condition which resembled bleeding from too much oil but after drying out and relaying, the surface was as hard and stable as could be desired. From limited experience on these projects it seems probable that a higher percentage of bituminous binder may be used successfully on surfacing in higher altitudes because the probability of bleeding is not so great as in the lower altitudes. This is possible because imperviousness to moisture is of paramount importance and cold weather material increases the stability of the surfacing.

Timely attention and maintenance of the surfacing is probably the most essential requisite toward insuring its success. The highway maintenance engineer knows that this is true for any type of highway in the higher altitudes where intensive maintenance is imperative during the short critical period of the spring breakup.

Cement Bound Macadam Test Road Being Built Near Chicago

Engineers planning to attend the Century of Progress Exposition in Chicago will have an opportunity to see an interesting test in road construction. To assist engineers and contractors in securing efficiency and economy in the design and construction of cement bound macadam, the Portland Cement Association is engaged in building an experimental road of this type, near Elmhurst, Ill., just west of Chicago. Sixty test sections are to be built, making a road 1,200 ft. long.

Field tests will be reinforced by investigations in the Association research laboratory. Crushed stone, slag, and gravel will be used in the various test sections, with grout of varying consistencies. Included with many tests will be the effect of vibration, as compared with rolling, in securing compaction and thorough penetration of the pavement.

Construction started during the week of June 12 and will continue approximately five weeks.

PREQUALIFICATION REQUIRED OF BIDDERS ON NEW MEXICO WORK.—The State Highway Commission of New Mexico on June 14 passed a resolution that the state highway engineer be instructed and authorized to pass upon the qualifications of any and all prospective bidders prior to delivering the applicant a bidding blank. The state highway engineer was authorized to reject any applicant for bidding blank if in his opinion the applicant is not qualified.

CONNECTICUT NOW REQUIRES LABOR AND MATERIAL BONDS.—A law has been passed by the Connecticut Legislature requiring labor and material bonds on all contracts awarded by the state or any of its political subdivisions on contracts in excess of \$500. Connecticut has up to the present been one of those comparatively few states which did not require the labor and material bond in connection with its performance bond requirements on public contracts.

The Wisconsin Road Builders have Developed Excellent Results with Their Highway Programs

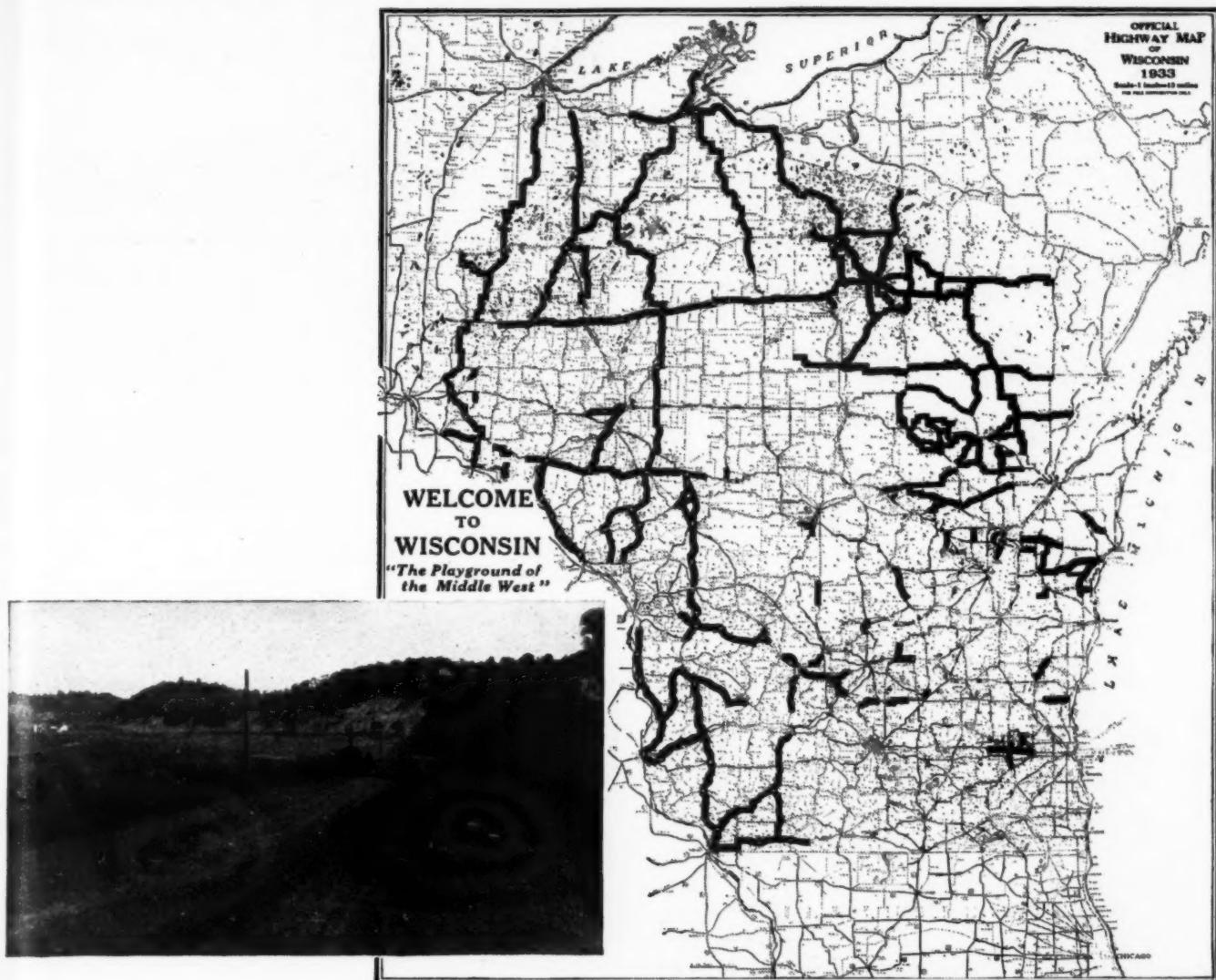
THE State of Wisconsin has approximately 25,000 miles of the total of 81,000 miles of roads in the State and County systems which have been surfaced or paved.

This construction has been distributed to meet traffic requirements which are seasonal and local to the greatest advantage.

In 1932 over 2700 miles of road were paved, surfaced, or treated for dust with Standard Asphalt Road Oil or Stanolind Asphalt Products.

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A Mixed-in-Place Construction Job in Vermont

By M. M. OGDEN
Koppers Products Company

AMIXED-IN-PLACE surface built during 1932 between the towns of Randolph and Bethel in Vermont provides an excellent example of the smooth-riding, skid-resistant surfaces which may be obtained at low cost with mixed-in-place method of construction, using local crushed gravel.

The contract was for 6.1 miles and it involved approximately the following items:

Common excavation, 71,000 cu. yd.
Rock excavation, 10,000 cu. yd.

Gravel base, 23,000 cu. yd.

Crushed gravel surface course, 4,630 cu. yd.

Refined coal tar, 107,000 gal.

The finished roadway was designed for 18-ft. width on tangents, with widening of 2 ft. on superelevated curves.

When the grading and drainage work had been completed, a 12-in. sub-base of gravel was placed and rolled, with great care to make it conform to the cross-section of the finished surface. A prime coat of $\frac{1}{3}$ gal. of Tarmac, 8-13 specific viscosity Engler at 40° C. was then applied to the sub-base and allowed to penetrate. No cover was necessary. One-half the roadway was done at a time and one-way traffic was maintained until penetration was completed to the point where the binder would not pick up.

Gravel and sand for the mixed-in-place surface course were found in a river bar about six miles from the south end of the job. A crushing, washing and screening plant was set up there and the materials were taken out and stored in stock piles until needed. The grading requirements for the gravel were that all must pass through a $1\frac{3}{4}$ -in. screen and be retained on a $\frac{1}{4}$ -in. screen. A 5 per cent tolerance was allowed on this requirement. The sand was very coarse, having an average fineness modulus of 3.40 and a color of 1.25. The average per cent of wear of the crushed gravel was 12.

The gravel course was put on the primed sub-base with a mechanical stone spreader to insure uniform depth. The depth of the finished compacted surface was specified at $2\frac{1}{2}$ -in., which required approximately 3-in. loose depth. This took about 900 cu. yd. per mile of 18-ft. roadway. Twenty per cent of sand was used as a filler and this was applied by a sand spreader, using approximately 150 cu. yds. per mile of 18-ft. surface.

The mixing operations followed immediately. An application of .67 gal. of Tarmac, 20 specific viscosity, Engler 40° C. was put on, with care not to overlap in the center. Mixing was done by a multiple blade re-tread mixer drawn by a Linn tractor and guided at the rear by a truck. Half the width of the road was mixed at a time and two strips were made down each side. A power grader then windrowed the material once from the center to the side and then spread it evenly again ready for the second application of Tarmac. (With the use of certain types of mixers, the grader could be eliminated.)

Next a second application of $\frac{1}{3}$ gal. of the same grade of Tarmac was applied and mixed as before, except that



Upper view: Screening and Washing Plant Erected on River Bank about 6 Miles from South End of the Randolph-Bethel Road Job, Where Gravel was Obtained from a River Bar. Middle: Spreading Crushed Gravel on the Base for Mixed-in-Place Surfaces on Randolph-Bethel Road. Lower: Mixed-in-Place Material Ready for First Application of Tar.

an additional trip was made by the mixer through the center of the road. The mixture was then spread to a



Upper: First Application of Tar to Crushed Gravel. Middle: Mixing the Tar Treated Aggregate with a Multiple Blade Mixer. Lower: Grader Windrowing Tar Treated Material After the Multiple Blade Mixer.

true and even depth and cross-section by the power grader and immediately rolled to a limited extent. In a few sections where the mix was a little lean, an additional 0.1 gal. of Tarmac was applied, mixed and rolled.

About 4500 lin. ft. of roadway was considered a good day's progress in mixing.

The seal coat was not applied until the entire surface had been completed. For the seal, 0.2 gal. of Tarmac,



Upper: Sanding the Seal Coat. Middle: Dragging Pea Stone and Sand into Seal Coat with a Semi-Rigid Light Drag Made of Woven Wire. Lower: Finished Surface of Mixed-in-Place Job between Randolph and Bethel, Vt.

40 specific viscosity, Engler at 40° C. was applied. Pea stone, ranging in size from $\frac{1}{4}$ to $\frac{3}{4}$ in. was spread uniformly over the seal coat with a sand spreader. Following this a very light covering of sand was applied in the same manner. Approximately 30 cu. yd. of pea stone and 24 cu. yd. of sand were used per mile of 18-ft. surface. They were distributed over the surface with a light drag made of woven wire, about 10 ft. square and of semi-rigid construction, drawn by a truck. This operation was followed by rolling.

The average cost of gravel mixed-in-place surfaces in Vermont in 1931 was \$3,600 per mile and for crushed stone mixed-in-place about \$5,600 per mile. The average cost of concrete surfaces in the same state during that year was \$19,400 per mile.

The contract for this construction work was awarded to the Lane Construction Company of Meriden, Conn.

Old Problems of Wooden Bridge Beams Solved

After a year of work in analysis and in the testing of 200 built-up wooden beams of many sizes, in which artificial "checks" of any desired depth were "made to order" in assembly, at the Forest Products Laboratory of the U. S. Department of Agriculture, the familiar wooden bridge takes a more secure place among bridge structures.

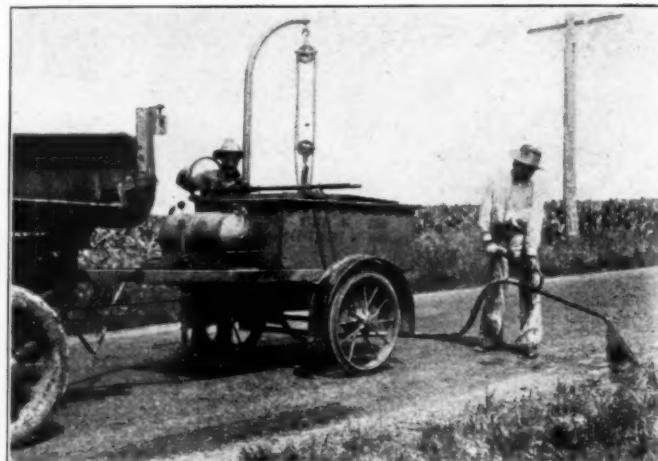
Practically all wooden beams have seasoning checks or fissures along the sides at midheight. The lack of a dependable shear theory for such beams has proved a source of confusion to bridge designers. The old accepted theory was ultra-conservative, calling for timbers large enough to resist certain supposed stress combinations that have not been verified in service. In some cases the full theoretical size of beams has been insisted upon. In other cases, a haphazard treatment of the shear factor has introduced an element of real risk. In too many cases, however, the uncertainty of the old shear theory has led to neglect of the merits and economy of wood altogether and replacement of wood by more expensive materials.

The Forest Products Laboratory's research demonstrates mathematically and by test that a single checked beam acts in part as two beams, one on top of the other, as a moving load approaches a support. Hence the shearing stress at midheight of the beam is much smaller than formerly supposed, and beams 30 to 50 per cent smaller in cross section than allowed by the old design may be used with entire safety.

The main findings have been adopted by railway and highway authorities and thus take their place in regular design and inspection work on bridge structures. The result of the new recommendations will be more efficient and economical construction as well as assured safety, says J. A. Newlin, principal engineer, who conducted the research with the assistance of G. E. Heck, engineer, and H. W. March, mathematician, all of the Forest Products Laboratory, at Madison, Wisconsin.

So long as sizes of bridge beams do not fall below the new standards, there is definite assurance that single-beam and two-beam action together will take care of the required shear stresses, according to the report. This conclusion is substantially verified by present railway bridge practice, and the new analysis warrants the expectation that hereafter highway bridge timbers will be less expensive and more accurately designed for the service they are to render with safety to the public. Beams will no longer need to be too large; on the other hand there will be less danger of making them too small for want of clear-cut knowledge.

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New Equipment and Materials

New Bituminous Mixer

A new bituminous mixer has been brought out by E. D. Etnyre & Co., Oregon, Ill. All operations of the mixer are controlled by one man. The machine has a power-driven hydraulic lift. It has a short wheelbase, 162 in., consequently a short

strength is required, all rigid junctions welded. It is extremely close-coupled, the conventional subframe being eliminated entirely. The mounting by which it is attached to the tractor is of the same simplicity as that used with the standard Bulldozer, there being no rubbing posts or complicated members whatever.



New Bituminous Mixer of E. D. Etnyre & Co.

turning radius. All material is moved five times. The width of mix is 10 ft. and the depth from 1 in. to 4 in.

The machine has 41 ft. of mixing blades and a 10 ft. leveling blade. All cutting edges and plow points can be easily replaced. The outer blades can be easily removed to reduce width for traveling over highways. The traveling width is 96 in. and the overall length (not including tongue) is 20½ ft.

New Bulldozer

A new tool of the bulldozer type is announced by R. G. Le Tourneau, Inc., of Stockton, Calif., manufacturers of Le Tourneau heavy grading equipment. The new tool is called an "Angledozer" and is stated to be a bulldozer capable of working at any angle to the tractor's line of travel. Originally designed as a snow-removal machine for use on a particularly difficult stretch of California state highway, in the high Sierra country, the "Angledozer" has been improved as a general-purpose snow removal machine and an adjustable bulldozer for contractors' use.

Chief characteristics of the "Angledozer" are its ease of adjustment to any angle of throw and any angle of blade pitch, its light weight, and its ability to work a continuous line, without backing, in moving snow off a highway or pioneering a road along a hillside.

In the "Angledozer" special and alloy steels liberally are used everywhere that

The "Angledozer" has a very high lift—4 ft. above the level—and a low drop—6 ft. below the track level. To adjust the blade for pitch two plain nuts are moved. To set either point of the blade up or down, a plain nut is screwed in or out. To change the angle of throw, or to change the throw from right to left, the brace bar is shifted. Control is through the regular Le Tourneau cable power control unit.

The time required to change the angle of the blade is only 20 minutes, and an equal period is required to change the throw from one side to the other, to dismantle the "Angledozer" (except fitting which do not interfere with use of the tractor for other purposes) or to remount the "Angledozer" on the tractor.

The use of a special spring steel construction across the front, the elimination of the subframe and wide use of alloy steels, coupled with a design which puts the weight where it is needed and avoids use of unnecessary weight everywhere, brings the total weight of the "Angledozer" down to 4,200 lbs.

New Axle for Fruehauf Trailers

A one-piece I-beam angle for its trailers has just been announced by the Fruehauf Trailer Co., Detroit, Mich. An outstanding feature of this new design, the announcement states, is that the entire axle—spindles and beam—is drop forged from one piece of chrome-molybdenum steel. In the Fruehauf I-beam axle, no welding or other operations which might weaken the structure of the metal need be performed.

Another important point in this new development is that the I-beam shape and the use of chrome-molybdenum steel have made it possible to vary the weight and thickness of the beam at certain points to meet the variations in stresses at these points. In other words, where strains are greatest more strength is provided. Thus, throughout the length of the axle every ounce of metal is working—there is no excess weight at any point.

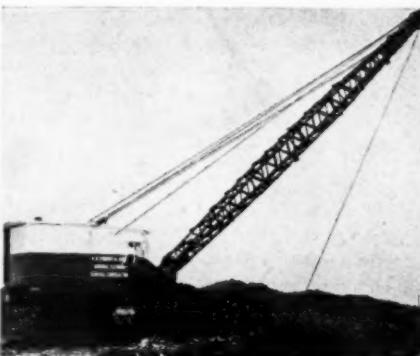
This new angle is cambered to conform to the average road crown and to compensate for the slight deflection which occurs in any axle under load.

New Marion Excavator

To broaden its activities in a market with which it has been associated since 1884, The Marion Steam Shovel Co., Marion, O., is adding to its line a complete series of clutch type fully convertible excavators.

These new Marion excavators are the straight friction fully convertible type consisting of a primary power unit, either gas, Diesel, or a single electric motor connected through a master clutch and speed reducing mechanism, directly to the main machinery. Thus, the various functions of hoisting, traveling, swinging, crowding and booming are independently controlled through friction clutches.

A decided advantage claimed for these new Marions is the ease and speed with which they can be changed over from shovel to dragline, crane, clamshell, or trench shovel, or vice-versa, while on the job. From the ground up, the simplest and most effective design has been incorporated in building this advanced series of

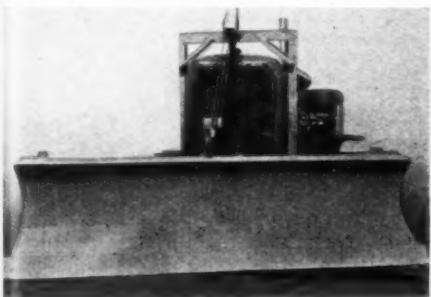


Type 371, Equipped with Dragline, in Operation on Large Contract in Illinois

clutch type excavators. The crawlers are chain driven and particularly designed for full self cleaning to avoid clogging and its undesirable effects. Besides the two drive sprockets for each crawler, they are provided with intermediate rollers, one for each shoe to prevent the crawler belt from becoming tucked between them. These rollers are narrow and rounded to permit the shoe to tip sidewise to conform to the contour of the ground. All crawler bearings are sealed against dirt.

The main lower frame casting is one extremely rugged and substantial steel casting. The swing gear is a one-piece steel casting bolted and dowelled to the top of this casting.

The roller circle is of the "live" type especially designed by Marion. In position, it represents a complete circle with the load applied top and bottom, similar to a roller bearing, thus keeping the load on the shafts to an irreducible minimum. An advantage claimed for this design is in the way the load is distributed over a number of rollers,



The "Angledozer"



Type 371 Marion Clutch Type Excavator, 1 1/4-Yd. Size, Equipped with Shovel, in Operation on a Large Contract in Illinois

preventing them from sliding and wearing flat.

Steering is accomplished by the operator from his position in the cab and in any position of the upper or revolving frame. Two levers operate through the center journal. One lever controls the steering to both crawlers, while the second lever controls two brakes which, when applied, are a chock preventing forward or backward movement against digging thrust. These brakes also act as travel brakes when required. Unusually high ground clearance combined with precautionary measures keep this mechanism clean. Bevel gears under center journal are enclosed in an oil tight case.

Considerable thought and study have been given to the design of the main machinery. Only two horizontal shafts are used. The horizontal clutch shaft which carries the swing and propel clutches receives power directly from the power unit. This clutch shaft is mounted on anti-friction bearings and the entire assembly of bevels, gears and bearings is enclosed in an oil tight cast steel case as protection against wear and misalignment.

The hoist shaft is mounted on anti-friction bearings. Two drums are mounted side by side and driven directly from the horizontal clutch shaft. They are fitted with removable laggings to permit various front end combinations and change of speeds for the various operations.

On these new excavators, Marion uses an effective and efficient type of external contracting band clutches that slip without overheating, take hold without grabbing or jerking and grip securely when entirely engaged.

The boom hoist consists of a drum mounted in the main base casting and driven through a self locking worm and wheel fully enclosed and running in oil. An automatic spring set brake prevents the boom from "creeping" down due to operating vibration.

Oversized capacity aptly describes the dippers used on these machines. Not only are they built to generous dimensions, but in such a way as to pick up their full rated load without excessive spillage. To be able to shake the dipper clear of its load has been given every consideration and will be an appreciated performance feature with the new Marion.

The shovel boom is all steel construction. The dipper handle is of the outside type, a combination of hard wood and steel. These Marions incorporate an improved design of chain crowd permitting angle of boom to be changed without chain adjustment.

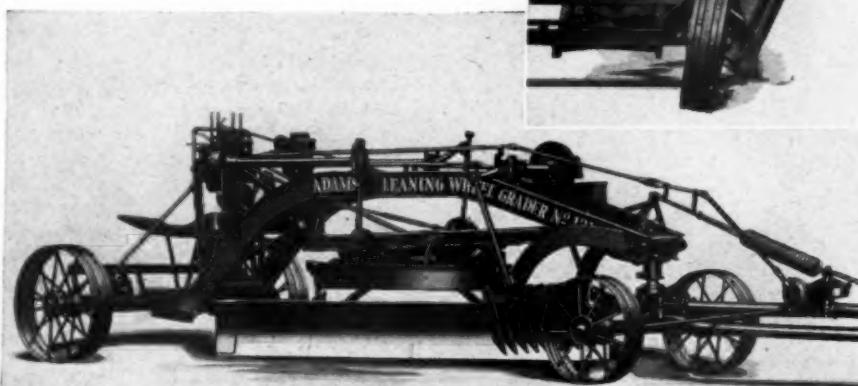
The boom for dragline, clamshell or crane is latticed angle construction furnished with removable middle sections and Marion's exclusive standard full guarded point which prevents cable fouling.

The cab is all steel fully enclosed type with doors roller mounted, fully adjustable windows and ventilators. The right front corner is cut back to improve the operator's vision. The rear is in three doors sliding past each other to permit easy access to the engine. Two flood lights together with full interior lighting and trouble light connections are standard equipment on all machines.

The many years of experience enjoyed by the Marion Steam Shovel Company have served as a criterion in the design and development of the new Marion line. Accurate workmanship and material control have always played an important part in the measurement of quality in the Marion plant, as the construction of Marion power shovels is controlled by the under-one-roof manufacturing policy of the company.

Adams Motor Controlled Grader

The illustration below shows the No. 121 leaning wheel grader of the J. D. Adams



Adams No. 121 Leaning Wheel Grader with Power Controls

Co., Indianapolis, Ind., equipped with power controls. Power for the controls is supplied by a single-cylinder air-cooled gasoline engine securely mounted in the grader frame; the engine develops 6 h.p. which, it is claimed, furnishes ample power to make any adjustment or combination of adjustments at any time. A fuller description of this grader appeared in the June issue.

New Federal Trucks

The production of three new 6-cylinder trucks by the Federal Motor Truck Co., Detroit, Mich., is announced by M. L. Pulcher, president. These new chassis are designated as 15A, 20A and 25A and are rated at 1 1/2 ton, 2 ton and 2 1/2 ton respectively. The outstanding characteristic of these new trucks is their unusually sturdy and substantial construction. An idea of the margin of safety that is built into them may be gained from the frames which have a maximum depth of 18 1/2 in. It is also evidenced by the chassis weights (standard short wheelbase), which are 3,500 lb. for the 1 1/2 ton, 3,900 for the 2 ton and 4,500 for the 2 1/2 ton.

These new models are equipped with 6-cylinder, 7-bearing truck engines which furnish plenty of power at a low governed engine speed. All three engines are similar in design but differ in size. Each is governed at 2,600 r.p.m. Sizes and horsepower developed at governed speed are: 1 1/2 ton—3 1/2 in. bore by 4 1/4 in. stroke, 58 horsepower; 2-ton—3 1/2 in. bore by 4 1/4 in. stroke, 67 horsepower; 2 1/2 ton—3 1/4 in. bore by 4 1/4 in. stroke, 72 horsepower. Features include 3-point suspension with rubber mounting, force feed lubrication, down draft carburetor.

Other noteworthy advantages are: Long wearing dry plate clutches, 4-speed transmissions on 1 1/2 and 2 ton models and 5-speed transmission with silent fourth on the 2 1/2 tonner; full floating rear axles; rubber bushed spring eyes that require no lubrication; roller bearing universal joints; 4-wheel hydraulic brakes.

In the design of these new models spe-

cial attention has been given to the welfare and comfort of the driver. Noise and vibration have been reduced or eliminated wherever possible through the use of rubber mountings for motors, mufflers and other parts. Clutches are equipped with vibration dampeners. Other features contributing to driver comfort include 3-way side and top ventilated cowl, lower and more comfortable cab, outside gas filler cap, large treadle type accelerator, and even a cigar lighter conveniently mounted on the instrument panel.

All models are supplied with a wide choice of wheelbase lengths to accommodate various sizes of body equipment.

New Signal Torch

A new torch has been placed on the market by the Shanklin Manufacturing Co., Springfield, Ill. Among the important features is a new easy on-and-off cap that it is claimed, absolutely will not leak. The cap has no threads. To put on it is simply placed on the neck of the torch and given a half turn. The torch has a new stream line



The Storm King is 8 in. High by 7½ in. Wide and Holds 3 Quarts of Kerosene

flame guard that automatically discharges carbon through the slit at the top and controls wind and air movements so as to give out a good even flame. The flame guard and wick holder are one piece.

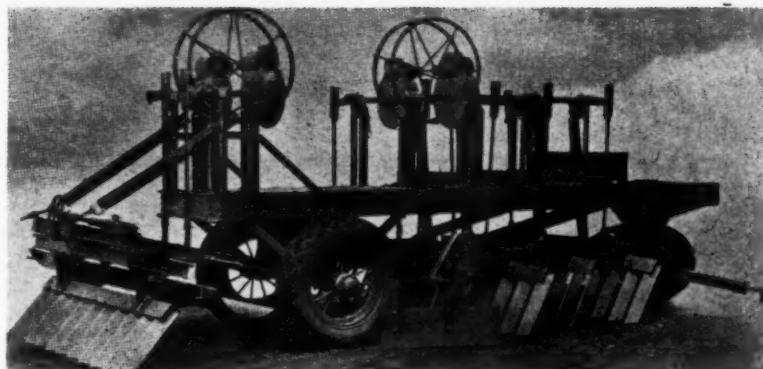
The torch has a scientifically weighted bottom that pulls in back to an upright position, no matter how badly it is tipped. Other features are a large handle for easy carrying and corrugated double strength construction. The torch is made of corrugated extra-heavy gauge steel and is constructed with a double lock seam that cannot break apart or leak. It is stated that the torch will maintain a constant flame through rain and wind storms of cloudburst proportions.

The Parsons Turbo Mixer

A new machine for drying and mixing black top in place on the road has been brought out by The Parsons Co., Newton, Ia.

The mixer follows the distributor and secures that desirable first mixing while oil is still hot.

The four sets of vanes in front are controlled by the two front hand wheels and



The Parsons Turbo Mixer

can be exactly adjusted by self-locking worm gear to any depth of material. The vanes rest on the surface when desired and ride easily on their spring cushioned control rods which also adjust pressure required on the subgrade.

The load on the control wheels is counterbalanced by tension springs making raising and lowering easy for one man.

The rear unit is equipped with both blade and vanes, which are quickly reversible, so either can be used as required. A trimmer with adjustment is attached to right side so the material cannot scatter, and it also assists in preventing the oil "run off" to the sides.

When the rear blade is in use it can be swung to 45° to either side by worm gear control so it can work either right or left side of the spread. The blade also keeps the shoulder free of scattered material and run off oil.

The approximate measurements of the machine are: Length over all, 22 ft.; width overall, 8½ ft.; height overall, 8 ft.; wheelbase, 12½ ft.; width of road covered by vanes, 8½ ft.; length of blade, 12 ft.; depth of blade, 1 ft. 10 in.

Marmon-Herrington Announces New Line of Trucks

A complete new line of four and six-wheel-drive motor trucks, consisting of 21 models with capacities from 1½ to 20 tons, is announced by the Marmon-Herrington Co., Inc., Indianapolis, Ind.

The new Marmon-Herrington line is divided into four series of four- and six-wheel-drive trucks, two of which are brand



Marmon-Herrington Model A10-4 Equipped with Specially Designed Box Type Body

new and two consisting of improved and refined models of the previous series. All vehicles are offered in either two- or three-wheel-base lengths and most of them can be purchased in one of two tire sizes.

Five smaller four-wheel-drive models are grouped in the new A series. There is one 1½-ton model, one 2½-ton model, one 3½-ton model and two 4-ton models. The next series is known as the TH-4 Series and comprises six four-wheel-drive models ranging in capacity from 4½ to 9 tons. Five six-wheel-drive models are grouped in the TH-6 series. These have capacities of 10 to 20 tons. The fourth group is the THD series and this consists of six models powered by Diesel engines. Three of these models are four-wheel-drive units and the other three are six-wheel-drive models. Capacities range from 7 to 20 tons.

Recent U. S. Patents Relating to Roads

Compiled by Patent & Technical Information Service, 1336 New York Avenue, N. W., Washington, D. C.

MAY 2, 1933

1,906,494. Playing Surfaces. Lewis H. Steward, Chicago, Ill., assignor to American Hair & Felt Company, Chicago, Ill. A playing surface of the character described comprising a felt layer, a layer of pervious concrete supporting said felt, a non-continuous layer of non-water-soluble adhesive between said felt and said concrete, and a bedding of coarse gravel or broken stone supporting said concrete.

1,906,549. Road Grader. George E. Dean, Grand Rapids, Mich., assignor to Charles G. Willett, Grand Rapids, Mich. In combination, a frame having two sets of spaced parallel members at either side thereof, two shoes located adjacent each of said sets of parallel members, bolt means extending from said shoes upwardly between said parallel members whereby the said shoes may be slid along the said parallel members, means for clamping each of the several shoes in its desired position, a turntable revolvably supported by said shoes and a beam rigidly attached to said turntable.

1,907,157. Rotary Scraper Having Power Control. Hyrum Ricks, Jr., Bell, Calif., assignor, by mesne assignments, to Lathrop Investment Corporation. In an earth scraper, the combination of: a scoop; a draft frame whereby said scoop is moved; a latch means whereby said scoop may be retained in digging or carrying position; a lever pivotally connected to said draft frame and said latch means; a net connected to said lever; a

threaded shaft engaging said nut; a bearing means carried by said draft frame and supporting said shaft; protector means attached to said nut and surrounding said shaft; and connecting means whereby said shaft may be connected to a power drive mechanism.

1,907,416. **Expansion Joint.** Albert C. Fischer, Chicago, Ill., assignor to The Philip Carey Manufacturing Company, Ohio. An expansion joint consisting of a preformed boardlike body of plastic material having one face provided with a groove for interlocking with paving material laid adjacently and in contact with the grooved face of the joint.

MAY 9, 1933

1,907,668. **Concrete Spreading Means.** John F. Robb, Cleveland Heights, Ohio. A concrete spreader comprising the combination with a truck frame and concrete holding drum mounted thereon, of a foldable distributing hopper mounted on the frame and adapted to directly receive material discharged from the drum, and means for folding and expanding the hopper into inoperative and operative positions, the hopper when folded occupying a space substantially the width of the truck frame, and when unfolded becoming operative to a length greater than the width of the said frame.

MAY 16, 1933

1,908,909. **Manhole Protector.** Christian William Manz, Buffalo, N. Y. In combination with a manhole frame, a removable member extending upwardly from said frame and defining an unbroken wall around the manhole to prevent entrance of surface fluids, and means for releasably securing said wall member with respect to said frame.

1,909,202. **Art and Product of Masonry Joint Fillers.** Charles F. Lytle, Sioux City, Iowa. The art of filling masonry expansion crevices, comprising treating sawdust with a pore filling substance to fill the pores thereof, adding to molten tarry substance a sufficient quantity of the sawdust to saturate the tarry substance and reduce the mixture to slow fluidity while heated, and pouring the heated mixture into place.

1,909,327. **Asphalt Pouring Device.** Charles H. Whymer, Athens, Ill. An asphalt pouring device comprising a cylindrical tank having a downwardly sloping bottom terminating in a pouring spout projecting from the wall of the can at the lowest point thereof in alignment with the bottom, a screen having a bottom flat edge supported on the bottom at about the center thereof and having an arcuate edge engaging the side wall of the tank, said screen sloping downwardly to the bottom and coacting therewith in forming a V-shaped trough whereby a space exists for strained asphalt below the screen contiguous to the spout, said screen having a slot therein, and a rod valve for closing the spout projecting through the slot and having a pointed end directed at a downward angle to the rod and lying along the sloping bottom of the tank, said stem being guided by the walls of said slot and said pointed end being guided by said sloping bottom during move-

ment of the rod valve to open and close the spout.

1,909,551. **Curbing.** William Leslie Ross, Wareham, Mass. In a curbing, an elongated body having a substantially semi-circular shaped recess extending the length thereof, and a roller seated in said recess and rotatably held therein by the walls thereof, the peripheral wall of said roller extending beyond one side of said body.

MAY 23, 1923

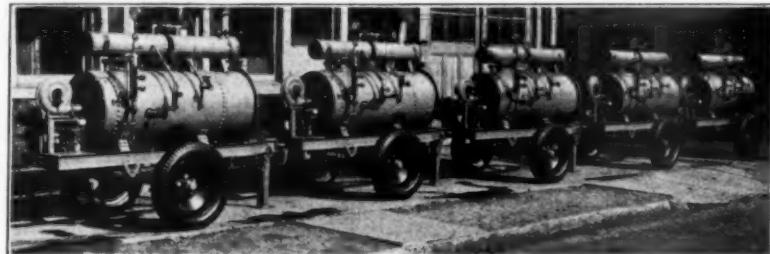
1,910,120. **Soil Shaping Side Attachment for Road Grading Apparatus.** Robert T. Mowbray, Waterloo, Iowa. A shoulder forming attachment adapted to be removably and adjustably vertically suspended from a wheeled grader, and including a laterally projecting beam structure carrying a laterally projecting swingable screw conveyor supported from the grader, an arched frame bridging said conveyor at its inner end ad-

crease resistance to further movement of the guard member.

1,911,931. **Expansion Joint for Pavements** and the like. Albert Skinner, West Chester, O. An expansion strip for pavements including plastic material, a binder of corn stalk fibres, and facing material consisting of burlap waste impregnating the faces of the strip.

Heaters and Boosters Speed Up Heating of Bituminous Materials

A number of State Highway departments have recently purchased Cleaver tank car heaters, a product of Cleaver-Brooks Co., Milwaukee, Wis. These include: Indiana, 6 one-car heaters; Kentucky, 5 two-car heaters; Kansas, 2 one-car and 1 three-car heater; Ohio, 5 three-car heaters; Georgia, 2 three-car heaters; Idaho, one-car heater; Colorado, one-car heater and



5 of 6 One-car Cleaver Heaters Shipped Main Union Division, Indiana State Highway Department

jaçent said main frame, flexible supporting means on said attachment for said arched frame, and a pair of flanged tread and guide wheels rotatably mounted on opposite end parts of the arched frame to ride upon the upper edge of the adjacent outer side wall of a paving body.

1,910,247. **Highway Marker.** Francis O. Heltzel, Youngstown, Ohio. A marker having a convex upper surface and a plurality of angular grooves in said upper surface leading from the central higher portion to the outer edge of the marker, said grooves forming a star shape upon the surface of the marker.

1,911,140. **Composition of Matter.** Albert C. Fischer, Chicago, Ill., assignor to The Philip Carey Manufacturing Company, Ohio. A preformed expansion joint comprising a plastic boardlike strip of bituminous material reinforced by a tangled mass of relatively long, stiff, but pliant, bristlelike vegetable fibers which are intermixed and distributed therethrough.

MAY 30, 1933

Re. 18,848. **Road Guard.** Harold T. Moore, Chicago, Ill., assignor to Tuthill Spring Co., Chicago, Ill. In a guard rail construction for roads, a vehicle guard member, a supporting structure therefor, comprising fixed supports, spring supports on said fixed supports and attached thereto at a point adjacent the ground surface, said spring supports formed with a plurality of spring portions, one adapted to come into operation when the other has yielded a predetermined degree and thereby to in-

booster; Tennessee, one-car heater. Twelve counties in Wisconsin own heaters and boosters. Some interesting information on high speed and economical heating of bituminous materials with portable tank car heaters and boosters has been compiled by Cleaver-Brooks Co. One user, for example, heated and unloaded 110,000 gal. of oil in one working day with a No. 2 Cleaver booster. During the season just past another booster unit heated approximately 175 cars. Another user, with one car heating unit and two boosters, heated approximately 3,000,000 gal. of road oil last season.

Cleaver tank car heaters are portable units, mounted on both trailers and trucks. They are built in four sizes with steaming capacities for any requirements. Although designed primarily for heating tank cars of bituminous materials to pumpable temperatures, they are used also for thawing out culverts and manholes, and for steam cleaning machinery and trucks.

Sullivan Moves St. Louis District Sales Office

The Sullivan Machinery Co., Chicago, Ill., announces that the St. Louis district sales office formerly located at 2015 Railway Exchange and the warehouse formerly located at Mt. Vernon, Ill., are now combined under the direction of D. M. Sutor, manager, at 2639-41 Locust Ave., St. Louis, Mo. A complete stock of parts for air compressors, hammer drills, drill sharpeners, hoists, coal cutters, coal loaders, cutter bit sharpeners and diamond drills will be carried.